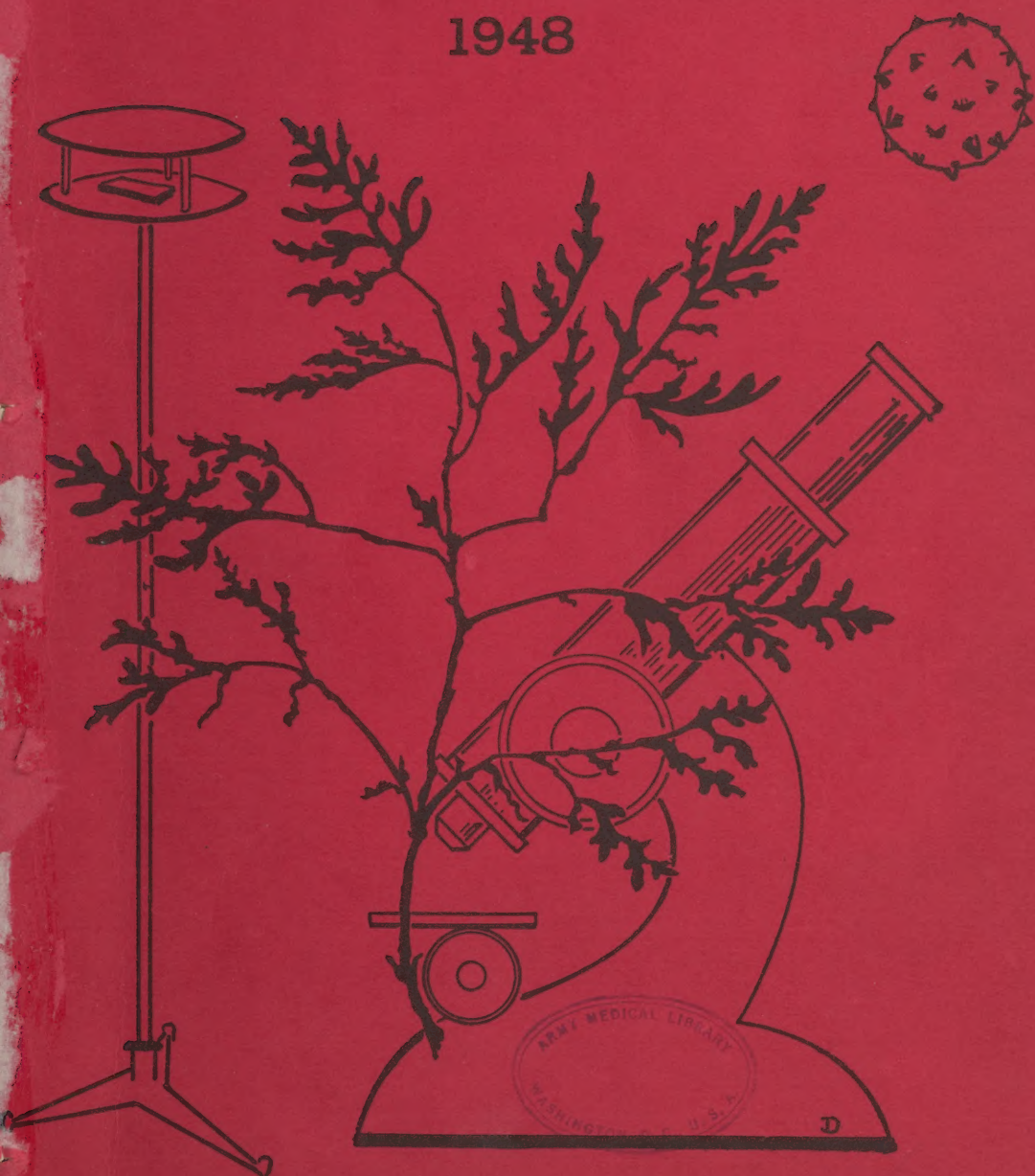


HAYFEVER STUDIES
IN
NEW HAMPSHIRE
1948



STATE OF NEW HAMPSHIRE

HAYFEVER STUDIES

IN

NEW HAMPSHIRE

1948

by
Frederick J. Vintinner
and
George W. Morrill, Jr.



State Department of Health

John Samuel Wheeler, M. D.
State Health Officer

Division of Industrial Hygiene

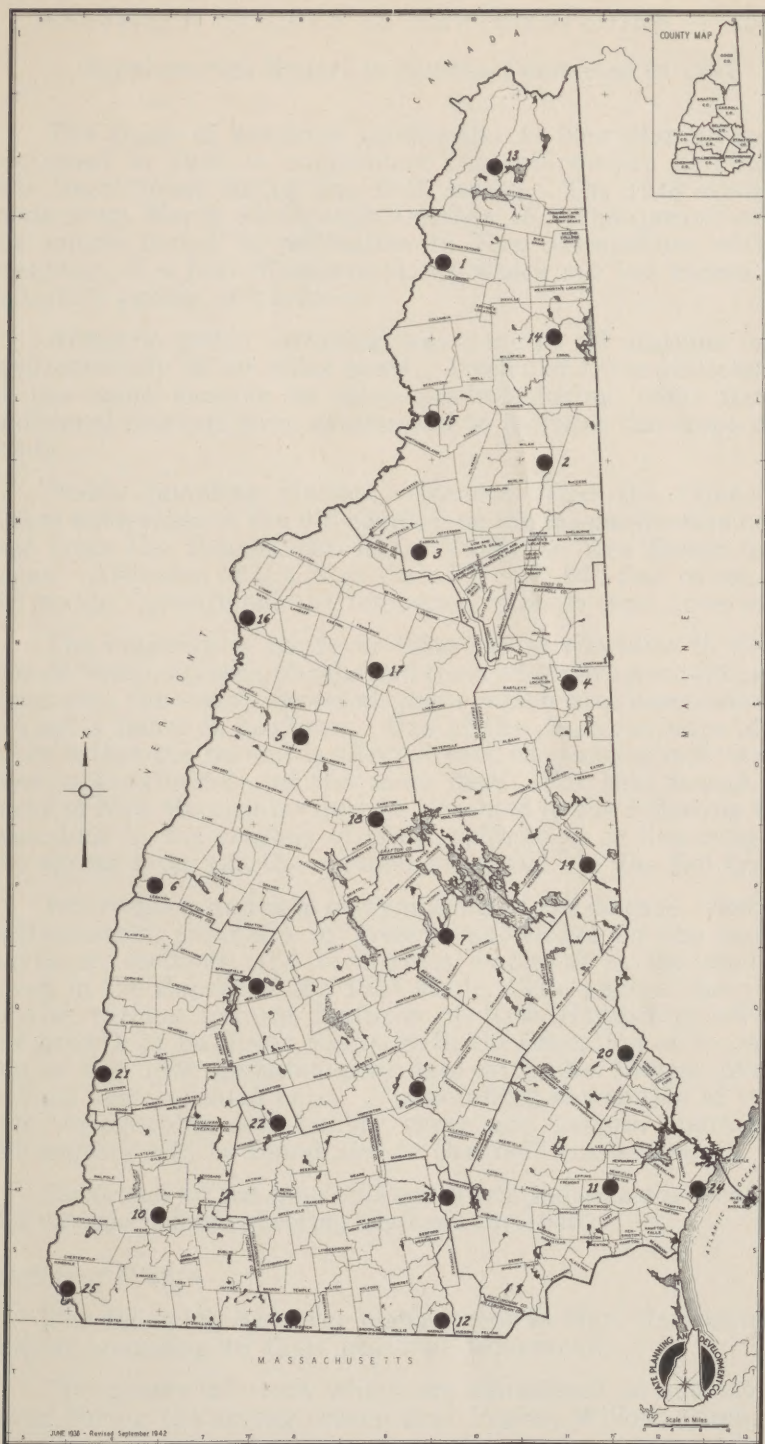
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Concord, New Hampshire

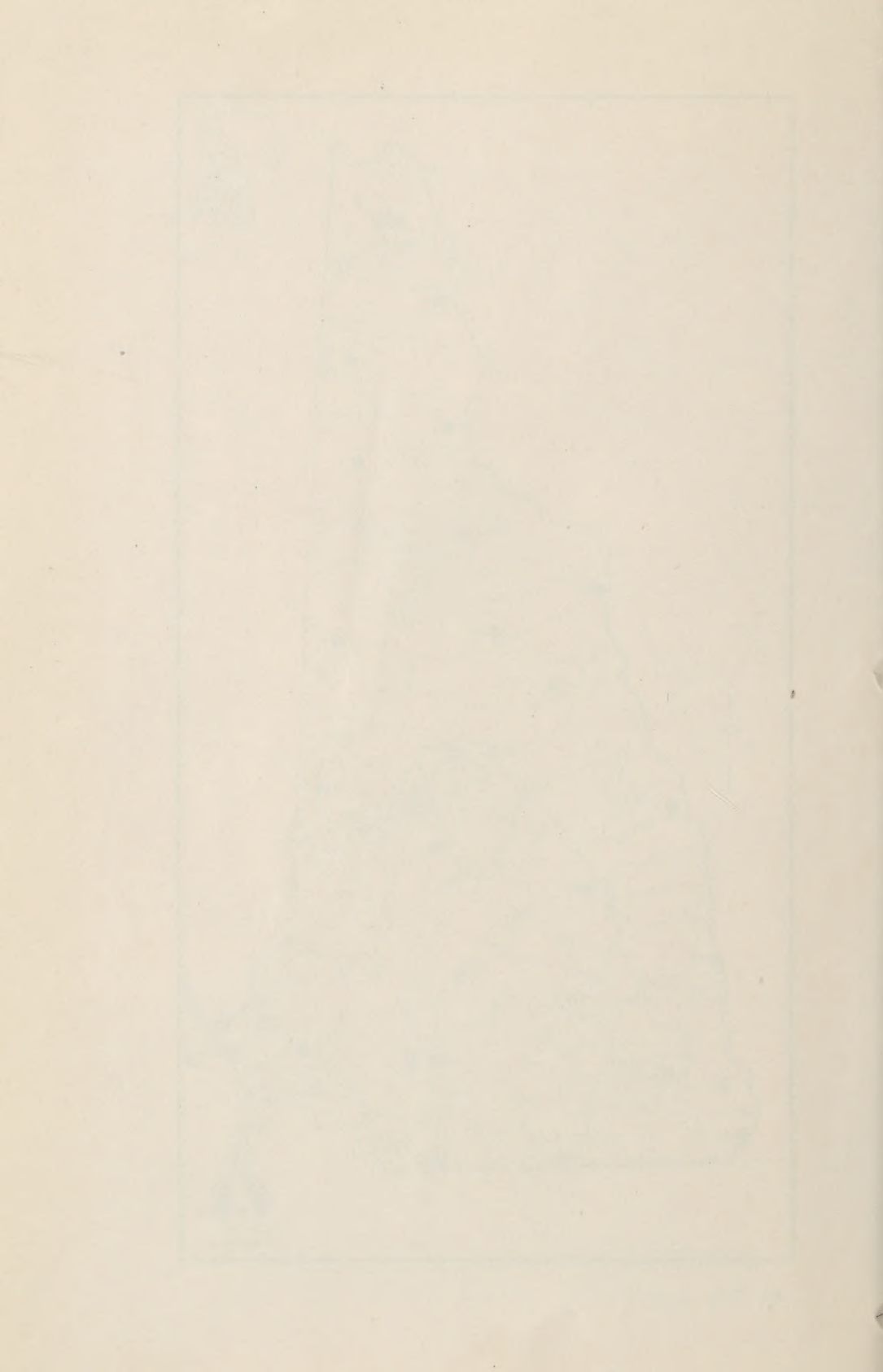
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HAYFEVER STUDIES IN NEW HAMPSHIRE — 1948

Supplemental Report to Studies Conducted in 1947

27 Apr 1950
The study of hayfever (pollinosis) in New Hampshire was continued in 1948 to supplement the information obtained by this Department during the 1947 season. The 1948 study was made from March 15 through October 15. This period covered the entire period of pollination in New Hampshire, with the exception of a few off-season plants which are not known to be causative agents of hayfever.

Airborne pollen sampling was done at 26 stations located approximately 25 air miles apart. Twelve of these stations were at the same location as those studied during 1947; fourteen additional stations were established to increase the scope of the study.

Pollen sampling stations extended from the Connecticut Lakes wilderness to the hill country on the Massachusetts border, and from the Connecticut River Valley to Rye Beach on the ocean. Altitudes of the sites varied from 1,660 feet to sea level. All major vegetational and temperature zones were covered.

The majority of hayfever cases are attributable to the pollens of weeds, grasses, shrubs and trees which are wind-pollinated. Generally, the showy flowered plants which are insect-pollinated are not a factor in hayfever. One of the characteristics of hayfever is that the patient is affected with the same symptoms each year, approximately on the same date. For this reason, hayfever in New Hampshire may be classified in the following types, according to the seasons of plant pollination or flowering: (1) the spring type, (2) the summer type, and (3) the fall type.

Information and data on symptoms of the disease, treatment, pathogenesis, summary of present knowledge on the cause of hayfever, methods, and techniques employed in the study are given in the Report of the 1947 study. The general description of the various natural features of New Hampshire affecting the growth of hayfever plants, with the exception of a comparison of the 1948 climatological data with the 75-year average, has not been repeated here. A generalized description of vegetation, topography, soil, timber types and general character of the country will be found also in the 1947 survey report.

Reference to the map on Page 3 will indicate the location of the various pollen collecting stations for 1948.

Hayfever Plants

The following hayfever plants occur in New Hampshire, arranged according to their seasonal occurrence:

The genera of trees which are considered as causing hayfever during the spring season are: Poplar, Willow, Birch, Elm,

Maple, Oak, Beech and Ash.

Species causing hayfever during the summer period are: Meadow Foxtail, Sweet Vernalgrass, English Plantain, June Grass, Sorrel Dock, Red Fescue, Meadow Fescue, Canada Bluegrass, Timothy, Redtop and Marshelder.

The fall or Ragweed hayfever season is dominated by the Common or Short Ragweed, with the occurrence of a few scattered pollen grains of Cocklebur and Solidago.

The most important of these genera or species in New Hampshire are: spring or tree season—Elm, Maple, Poplar, Oak and Birch; summer or grass season—Sweet Vernalgrass, June Grass, Orchard Grass, Timothy and Redtop; fall season—Short Ragweed, the most important species pollinating; in fact, Ragweed is the principal offender in this State.

Willow, Beech, White Ash, Meadow Fescue, Red Fescue, Meadow Foxtail, Sorrel Dock, Canada Bluegrass, Cocklebur, Tall Ragweed and Marshelder occur so infrequently or in such small stands that they are not major causative agents of hayfever in this State.

Climatological Data

The following tables are from the United States Weather Bureau records for Concord, New Hampshire. These records cover a period of at least 75 years and represent the various annual ranges. The data are representative of the entire State up to the medium altitudes, which would cover the major area of the State. All of the pollen collecting stations were well within this zone.

Comparative Data—Concord, New Hampshire (Averages from all available records, including the year 1946)

	TEMPERATURE (°F)			RELATIVE HUMIDITY (per cent)			
<i>Month</i>	<i>Mean Maximum</i>	<i>Mean Minimum</i>	<i>Mean Monthly</i>	<i>1:30 AM</i>	<i>7:30 AM</i>	<i>1:30 PM</i>	<i>7:30 PM</i>
Jan.	29.2	8.9	19.0	78	79	56	70
Feb.	31.0	9.6	20.3	76	77	54	66
Mar.	38.8	20.0	29.4	76	76	52	62
Apr.	52.6	30.7	41.6	77	73	46	59
May	64.8	40.9	52.9	85	74	49	64
June	73.5	49.9	61.7	87	77	52	67
July	79.0	55.9	67.4	89	80	51	70
Aug.	76.4	54.6	65.5	91	84	53	73
Sept.	69.1	47.1	58.0	92	86	53	77
Oct.	58.6	37.1	47.8	86	85	53	73
Nov.	44.5	26.5	35.5	82	82	61	73
Dec.	32.9	15.0	24.0	78	80	58	71
Annual Mean	54.2	33.0	43.6	83	79	53	69

Comparative Data—Concord, New Hampshire
(Averages from all available records, including the year 1946)
PRECIPITATION SUNSHINE WIND
(inches)

<i>Month</i>	<i>Total</i>	<i>Snowfall (Unmelted) Total</i>	<i>Number of Hours</i>	<i>Percent of Possible</i>	<i>Average Hourly Velocity</i>	<i>Prevail- ing Dir.</i>
Jan.	2.98	17.9	139	50	6.1	NW
Feb.	2.65	17.3	154	54	6.5	NW
Mar.	3.11	11.6	199	57	6.6	NW
Apr.	2.97	4.6	205	54	6.9	NW
May	3.12	0.1	226	53	6.0	NW
June	3.24	T	268	57	5.2	NW
July	3.69	0.0	273	57	4.8	NW
Apr.	2.97	4.6	205	54	6.9	NW
Sept.	3.47	T	198	55	4.8	NW
Oct.	3.23	0.1	163	49	5.3	NW
Oct.	3.23	0.1	163	49	5.3	NW
Nov.	3.27	5.3	122	44	6.0	NW
Dec.	2.89	12.1	112	43	5.9	NW
Annual	38.12	69.0	2323	53	5.7	NW

NUMBER OF DAYS

<i>Month</i>	<i>Average Cloudi- ness (Scale 0-10)</i>	<i>Clear</i>	<i>Partly Cloudy</i>	<i>Cloudy</i>	<i>Precip- itation 0.01 inch or more</i>	<i>Snow, 0.01 inch (Melted)</i>	<i>Thunder- storms</i>	<i>Fog Dense</i>
Jan.	5.5	11	8	12	11	8	#	1
Feb.	4.9	12	7	9	9	7	0	1
Mar.	4.8	13	8	10	10	5	1	2
Apr.	5.2	11	9	10	11	3	1	1
May	5.3	12	9	10	10	#	3	3
June	4.8	12	10	8	10	0	5	4
July	4.7	12	12	7	10	0	6	7
Aug.	4.7	13	11	7	10	0	5	6
Sept.	5.0	12	9	9	10	#	2	9
Oct.	5.3	12	8	11	9	#	1	6
Nov.	5.9	9	8	13	10	3	#	3
Dec.	5.9	10	7	14	10	6	#	1
Year	5.2	139	106	120	120	32	24	44

The precipitation effecting the growth of plants in New Hampshire during the normal growing season is furnished primarily by thunder-storms. Records for thunder-storms would not cover the upper third of the State above the White Mountains area, nor would they be expected to cover about one-half of the center part of the State around the Lakes Region. The wind velocities as reported in Concord would apply to the entire State, with the exception of the extreme north and along the seacoast, where they would be somewhat higher. The higher altitudes of the State are, with very few exceptions, those in which no major hayfever plants would occur. At these altitudes the land is heavily forested, primarily with the Spruce-Fir type, or is barren rock above timberline. Therefore, the figures given in the previous table would be indicative generally of the growing conditions for hayfever plants.

A comparison of the Weather Bureau records for 1948 with those for 1947 and the mean annual records reveals the following:

The precipitation for March, 1948, compared with the mean annual records was -0.78 inches; compared with the year's total, -2.84 inches. Compared with the 1947 season, precipitation was -0.73 inches, temperature was 2° above normal and 0.5° below the 1947 season. The first half of the month the temperature averaged 5° below the normal but the last half had slowly rising temperatures which melted an excessive snowcover.

During the month of April, 1948, precipitation exceeded the mean by 0.63 inches; the 1948 yearly total was deficient by 2.21 inches. Compared with the 1947 season, the precipitation was 0.43 inches in excess. Temperature when compared with the normal was in excess by 2.2°; compared with 2.3° in excess of the 1947 season. This month in 1948 is described as being an average April.

The month of May, 1948, compared with the normal, had an excess precipitation of 2.03 inches and compared with the yearly average there was a deficiency of 0.18 inches. When compared with the 1947 season there was an excess precipitation of 1.67 inches in 1948 for the month. There was a temperature deficiency of 0.1° compared with the normal, and a deficiency of 1.2° compared with 1947. This month is characterized as an unusually wet month. There were 18 consecutive days on which a trace or more of rainfall was recorded. The last killing frost in 1948 occurred on May 2.

The month of June, 1948, was characterized by an excess of 1.37 inches of precipitation compared with the mean, and 1.19 inches with the yearly average for this month. There was a deficiency of 0.47 inches compared with June, 1947. The temperature was characterized with a deficiency of 0.1° compared with the normal, and with 1947 a deficiency of 0.2°. This month in 1948, as in 1947, is characterized by cool weather during all but the final week. Rainfall amounting to 4.56 inches removed the deficiency which existed since the first of the year.

The month of July, 1948, is characterized by a deficiency of 1.15 inches of precipitation compared with the mean, and -1.15 inches with the yearly total. There was a deficiency of 1.41 inches of precipitation over 1947. The temperature is characterized with an excess of 2.6° compared with the normal and a deficiency of 1.8° compared with 1947.

August, 1948, is characterized by a deficiency of 1.81 inches of precipitation when compared with the monthly mean, and -2.96 inches compared with the yearly mean. In comparison with August, 1947, there was an excess of 0.55 inches in 1948. The temperature had an excess of 0.36° compared with the mean and a deficiency of 1.2° compared with 1947. The most notable feature was a severe heat wave during the final week. Daily maximum temperature records were established on three days



Short Ragweed Growth in Residential Areas.

*Closeup of Short Ragweed Before Pollination Showing
Growth Habit.*





**WILLOW
(SALIX)**



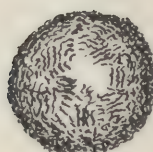
**BIRCH
(BETULA)**



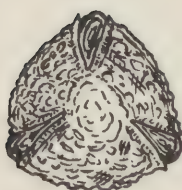
**MAPLE
(ACER)**



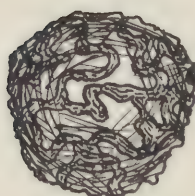
**ASH
(FRAXINUS)**



**POPLAR
(POPULUS)**



**OAK
(QUERCUS)**



**ELM
(ULMUS)**



**BEECH
(FAGUS)**

650X

G.W.M.

and equalled on two other days.

The month of September, 1948, had a deficiency of 3.04 inches of precipitation compared with the monthly mean, and a deficiency of 4.81 inches when compared with the annual mean. Comparison of September, 1948, with September, 1947, indicated a 2.09-inch deficiency in 1948 precipitation. The temperature during the month exceeded the mean by 2.2° and 1947 by 0.6° . Measurable precipitation was recorded on only three days, which is a record for September. The first killing frost in 1948 occurred September 17.

October, 1948, is characterized by a deficiency of 1.41 inches of precipitation compared with the monthly mean, and a 6.22-inch deficiency compared with the annual mean. Comparison of October, 1948, with October, 1947, indicated an excess precipitation of 0.85 inches in 1948. The temperature deficiency was 0.4° compared with the mean, and 7.8° when compared with 1947.

The average dates of the killing frosts, from records extending from 1851 to 1948, were May 5 and October 3. The average growing season is 150 days.

During the 1948 season the last killing frost in the spring occurred May 2, and the first in the fall was September 17. During the 1947 season the last killing frost occurred May 15 and the first in the fall on September 27. This would indicate the 1948 growing season to be 137 days and the 1947 season to be 135 days, which is 13 days and 15 days, respectively, below the average.

The dates for the average growing season would not apply to most of the area in the northern zone above the mountains, and particularly in that area in the mountain zone which lies above the medium altitudes. These figures would also be somewhat modified in the coastal area by the effects of the ocean. The growing season decreases ten to twenty days from the south to the north.

The total annual precipitation increases from 38 inches in the southern part of the State to 44 inches in the extreme north. The normal summer rainfall increases from approximately 10 inches in the south to 13 inches in the north; these figures are for the months of June, July and August.

The altitude of New Hampshire varies from zero at the coast to 6,262 feet above sea-level at the top of Mt. Washington. These extremes offer a wide variation of weather, altitude, vegetation and soils. A comparatively small area of the State exceeds a moderate altitude of 4,000 feet.

A general comparison of the 1947 climatological data with 1948 indicates that the latter season appreciably favored the growth of Ragweed. The yearly cumulative precipitation, compared with the normal, ended March with a 3-inch deficiency.

The total rainfall gradually increased during April and May, reaching a climax in June with an excess of 1.19 inches. From June until the end of October there was a deficiency in rainfall which finally accumulated to a total of 6.22 inches. During the first of the growing season for the various plants, there was an adequate amount of precipitation, stimulating seed germination and providing the plants with a good start. During the latter part of the growing season, the weather became progressively drier, which would tend to favor Ragweed over other types of vegetation, since it is, by nature, a poor land and dry land plant. This is indicated by the comparison of the results of reconnaissance surveys made during the 1947 and 1948 seasons. Places which were listed as having light growths of Ragweed during the 1947 season were found to have heavy growths during 1948. In addition, evidence to support this conclusion is found by an examination of the graphs of pollen incidence and occurrence, as given under the data for the various pollen sampling stations. It will be noted that the airborne Ragweed pollen densities were greater in 1948 than in 1947 at the same sampling locations.

Location of Sampling Stations

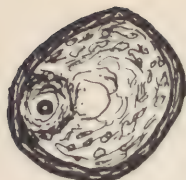
Pollen collection stations were located approximately 25 air miles apart. Reference is made to the map on Page 3 which presents station locations geographically.

Stations were located wherever possible in places where personnel were available seven days a week. With the cooperation of the State Fish and Game Department, personnel at five fish hatcheries changed the slides daily. Dr. H. Baldwin, of the New Hampshire Forestry and Recreation Department, maintained a device at the Fox State Experimental Forest. Professor F. E. Hodge of Colby Junior College, assisted in this study while making daily weather observations. Mr. Loys Wiles maintained a collecting device on the campus of Holderness School. Other stations were located at homes or offices of various local health officers and other interested citizens. Two of the stations were at the offices of personnel of the State Department of Health.

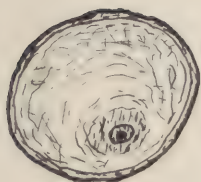
Representative sampling was obtained by locating the stations as nearly the same distance apart as possible throughout the State. They were located from the Spruce-Fir forest area in the north to the border of the State of Massachusetts; and from the seacoast on the east to the Beech-Birch-Maple forest in the southwest. Vegetation, soil, altitude, and population were considered in the location of sampling station distribution.

Results of Study at Sampling Stations

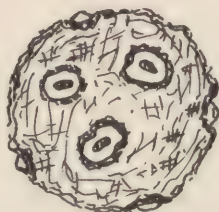
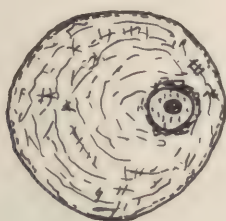
Each sampling station has been dealt with separately in respect to airborne pollen density, Ragweed growth, and other factors relating to the incidence of hayfever. The basis for the evaluation of Ragweed growth is discussed in detail in the section on reconnaissance surveys. These data are the result of exam-



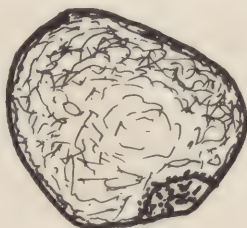
JUNE GRASS **REDTOP**
(POA PRATENSIS) **(AGROSTIS ALBA)**



CANADA BLUEGRASS **ORCHARD GRASS** **SORREL DOCK**
(POA COMPRESSA) **(DACTYLIS GLOMERATA)** **(RUMEX ACETOSELLA)**



TIMOTHY **ENGLISH PLANTAIN**
(PHLEUM PRATENSE) **(PLANAGO LANGEOLATA)**



SWEET VERNALGRASS
(ANTHOXANTHUM ODORATUM)

650X

Summer Hayfever Pollens

G.W.M.



**SHORT RAGWEED
(AMBROSIA ELATIOR)**



**COCKLEBUR
(XANTHIUM SPECIOSUM)**



**GOLDENROD
(SOLIDAGO)**

650X

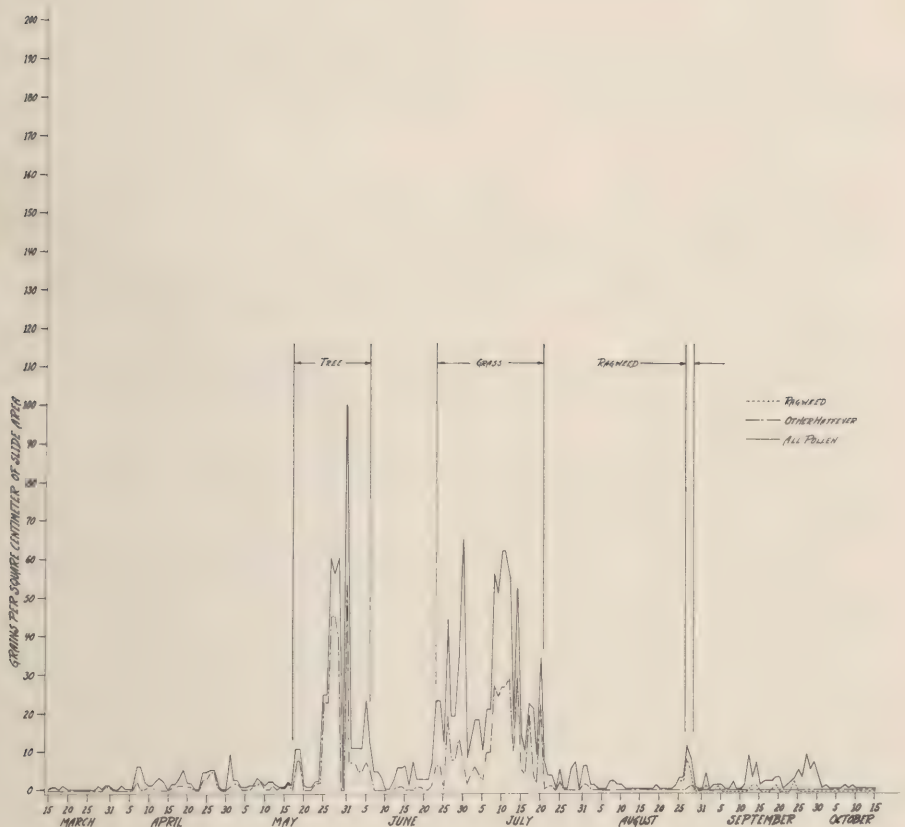
G.W.M.

ination and identification of pollens on 7,000 slides, which were exposed and handled according to techniques prescribed by the American Academy of Allergy. All pollen counts given are for one square centimeter of slide area. Information will be presented in a semi-tabular form for convenience.

A physical description of the first twelve pollen collecting stations will not be repeated in this publication. They will be found under the station discussions in the report of the 1947 study.

STATION NO. 1—Colebrook

The following graph indicates the density and frequency of airborne pollens at this site:



An examination of the graph and records indicates the following pollen grain occurrences:

Tree:

Poplar: April 7, 10, 16, 18, 19, 20, 24, 26; May 1, 2, 4, 7-9, 12, 16 and 18. The largest number occurred May 18, when fourteen were seen.

Elm: April 24-26, 28; May 1, 2, 9, 14, 18, 23 and 25. The greatest number appeared on April 26, when seven were recorded.

Birch: May 25, 27-29, 31; June 1, 3, 5, 6 and 13. The greatest number occurred May 31, when forty-two were recorded.

Maple: May 25, 27-29, 31; June 1, 3, 5 and 6. The greatest number appeared May 27, when fifteen were recorded.

Willow pollen occurred only once, May 1, when one grain was recorded.

There were no other tree hayfever pollens seen at any time.

Tree pollens appeared on the following number of days in numbers to induce hayfever: Elm, 1 day; Maple, 4 days; Poplar, 2 days; and Birch, 8 days.

Grasses:

June Grass: June 18, 22, 23, 26, 27 and 29. The highest count was June 26, when ten were seen.

Sweet Vernalgrass: June 23, 26, 27, 29, 30; July 2, 4, 6, 8, 9, 10, 12-14, 16 and 20. The greatest number were ten on July 10.

Redtop: June 23, 26, 27, 29, 30; July 1, 3, 8-10, 12-15, 17 and 20. The greatest number appeared July 8, when eleven were counted.

Canada Bluegrass: June 29, 30; July 4-6, 8, 9 and 10. The greatest number occurred July 9 and 10, when three were counted.

Timothy: June 29; July 3, 5, 6, 8-10, 12-20, 22, 24, 31; and August 1. The greatest number occurred July 10, when fifty-two were seen.

Orchard Grass: June 26, 30; July 3, 6 and 20. The greatest number occurred July 3 and 6, when two grains were recorded.

No other hayfever grass pollens appeared on the slides at any time.

Ragweed:

Short Ragweed: August 25, 26-28; September 1, 4, 13, 14, 18 and 24. The greatest number occurred August 27, when eight were recorded.

Grass pollens occurred earlier, in greater frequency, and there were a greater number of species recorded. Ragweed appeared about three days later and on ten days instead of two. There were only two days during the 1948 season in which Ragweed pollen occurred in such numbers to have effected Ragweed hayfever, August 27 and 28. The area around this station from July 21 to August 24 was comparatively free of hayfever pollens.

The following graph indicates the daily occurrence of airborne pollen grains at this location:



An examination of the graph and records indicates the following:

Tree:

Willow: March 16 and April 1, one grain being seen each day.

Poplar: March 1, 2, 28, 30; April 5, 7, 8, 16, 19, 21, 23, 26; May 1 and 4. The greatest number appearing were twenty-one on April 23.

Birch: April 6, 16, 23, 25; May 9-19, 21, 23-28, 30, 31; June 1-5, 6 and 29. The greatest number appearing were 208 on May 28.

White Ash: April 6, 21; and June 4. There was only one grain occurring on any of these three days.

Elm: April 5, 16, 18, 19, 21, 23, 25, 26; May 1, 4, 6, 15, 16, 19, 21, 23, 24, 28; June 2, 3 and 4. The greatest number appeared May 19, when fifty-two were counted.

Maple: May 11, 21, 24, 25-28, 30, 31; and June 1-5. The greatest number occurred May 28, when thirty-seven were recorded.

Beech: June 2-5. The greatest number occurring were ten on June 2 and 4.

Oak: June 2-5. The greatest number occurring were four on June 5.

Tree pollens appeared on days sufficient to effect hayfever as follows: Elm, 5 days; Maple, 12 days; Poplar, 1 day; Birch, 17 days; and Beech, 2 days.

Grasses:

June Grass: June 7, 15, 16, 20, 23, 24, 30; and July 2. The greatest number occurring were four on June 16.

Timothy: June 19; July 2, 7-10, 14, 17, 18 and 20. The greatest number occurring were seven on July 9.

Sweet Vernalgrass: June 24; July 2, 8, 9 and 17. The greatest number occurring were four on July 9.

Orchard Grass: July 1 and 8. The greatest number appearing were five on July 8.

Canada Bluegrass: July 7-9, the greatest number being two on July 9.

Ragweed:

Cocklebur: August 18, 21, 22, 24; and September 8. The greatest number occurring were two on August 21.

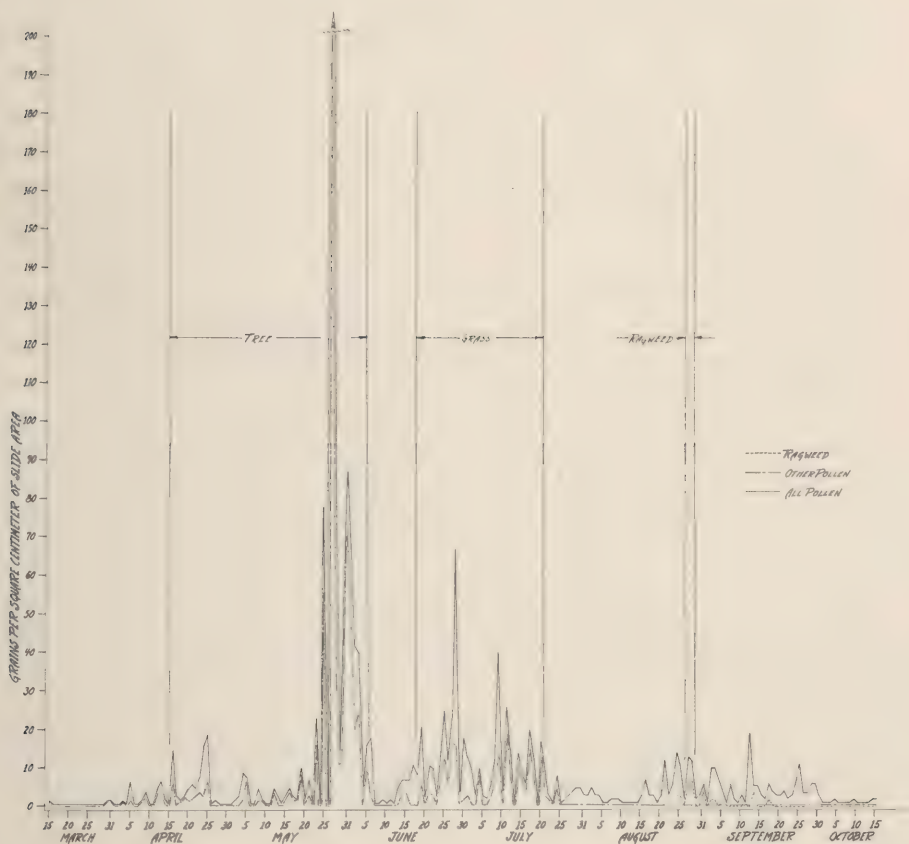
Short Ragweed: August 16-24, 26, 30; September 1, 3, 4, 6, 8-17, the greatest number being seventy-four on August 21.

A comparison of the 1948 hayfever season with the 1947 season indicates the following:

There were a greater number of species of grass pollens occurring, and they occurred on more days. There were only a few days, however, when the count was high enough to effect hayfever. This period occurred June 16 and July 7 to 9. Ragweed pollen occurred a week earlier in 1948 than in 1947 and also ten days longer. The periods from August 17 to 24, and September 1 to 7, were the periods in which Ragweed pollen occurred in such abundance as to be conducive to hayfever.

STATION NO. 3—Carroll

The following graph indicates the occurrence and density of the various pollens:



An examination of the graph and records indicates the following appearance of pollen grains:

Tree:

Poplar: March 15, 31; April 3, 12, 13, 16, 19-23, 24; May 4, 5, 8, 9, 12 and 15. The greatest number appearing were six on April 16.

Willow appeared on the slide only once, March 31, when one grain was recorded.

Maple: April 5; May 23, 25, 27, 28, 31; June 1-3 and 5. The greatest number occurring were fifty-three May 27.

Elm: April 8, 9, 12, 18, 24, 25; May 12, 18 and 27. Two grains appeared on seven of the previously listed days.

Birch: May 1, 16, 17, 19, 21, 23, 25, 27-31; June 1-3, 5, 6, 14, 15 and 19. The greatest number occurred May 27, when 318 were seen.

Oak: May 23, 25, 27, 28, 31; June 2 and 3. The greatest number occurring were five on May 27.

Beech: May 31; June 5 and 6. The greatest number were three on May 31.

White Ash: May 31 and June 1. On each of these days there was only one grain seen.

Tree pollens occurred as follows in numbers to induce hayfever: Maple, 1 day; Poplar, 1 day; Birch, 11 days.

Grasses:

Sweet Vernalgrass: June 14, 24, 25, 27, 28; and July 9. The greatest number to occur were three on June 27.

June Grass: June 19, 21, 22 and 27. The greatest number to occur were four on June 19.

Orchard Grass: June 25, 27; July 11, 12, 14-18. The greatest number to occur were nine on July 11.

Timothy: June 24-28, 30; also July 1, 4, 7-9, 11, 12, 14-18, 20-22 and 24. The greatest number to occur were eleven on July 9.

Redtop: June 24-28; July 1, 8, 11, 12, 14, 17, 18, 20, 21 and 24. The greatest number to appear were seven on July 20.

Canada Bluegrass: June 25, 26, 28; and July 11. The greatest number to occur were three on June 25.

Ragweed:

August 24, 25, 27, 28, 31; September 2, 3, 5, 13 and 17. The greatest number occurring were six on August 28.

There were no other hayfever inducing pollens occurring at this station.

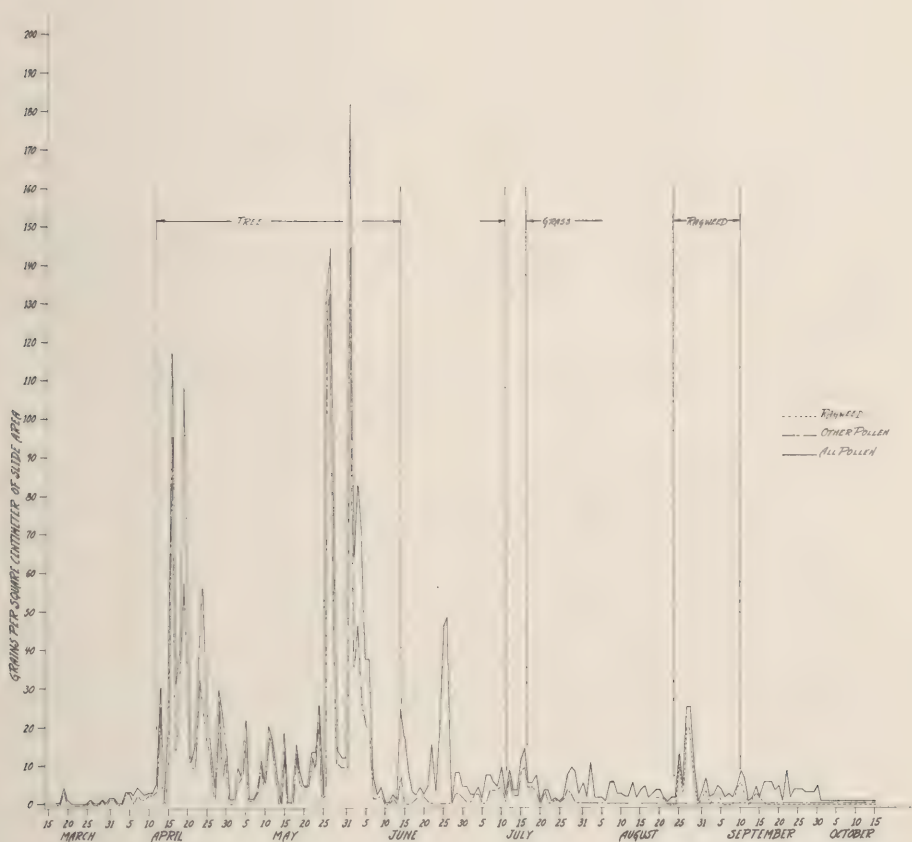
A comparison of the 1948 season with the 1947 indicates

the following:

Hayfever inducing pollens of the grasses occurred in much greater frequency and numbers during 1948. There were approximately eight days in which these pollens occurred in such numbers as to be conducive to hayfever. Ragweed pollen occurred on ten days in 1948, but there were only two days in which it occurred in such quantities as to effect hayfever. The 1947 season had no days in which Ragweed was recorded in numbers to effect hayfever.

STATION NO. 4—Conway

The following graph indicates the occurrence of the various pollens during the growing season:



An examination of the graph and records indicates the following pollen grain occurrences:

Tree:

Poplar: March 19, 26, 31; April 4, 5, 7-10, 12, 13, 15, 16, 18, 19, 22-30; May 3-5; and June 2. The greatest number occurred April 23, when twenty-seven were recorded.

Birch: March 19, 29, 31; April 27; June 3-5, 8-13, 15, 18-20, 20-30; July 1-5, 8 and 14. The greatest number appeared June 11, when fifty-three were recorded.

Willow: March 31; April 4 and 5. There was only one grain recorded on each of these three days.

Elm: April 10, 12, 13, 15-26, 29, 30; May 3-6, 9, 11 and 12. The greatest number occurring was ninety-one on April 16.

Maple: April 23, 25; May 9, 11, 12, 24, 26-28, 30; and June 1-5. The greatest number to appear was thirty-six on June 1.

White Ash: April 23, 25; May 27, 28; June 2 and 4. The greatest number occurred May 27, when three were seen.

Oak: May 23, 27, 28, 30; June 1-5 and 7. The greatest number appeared June 1, when forty-five were recorded.

Beech: May 26-30; June 1-5 and 9. The greatest number to appear was ten on June 1.

Tree pollens occurred in numbers sufficient to effect hayfever on the following number of days: Elm, 12 days; Maple, 3 days; Poplar, 6 days; Birch, 21 days; Oak, 5 days; and Beech, 3 days.

Grasses:

Canada Bluegrass appeared once, when one grain was recorded on June 4.

June Grass: June 12, 18 and 20. On these three days there was one grain recorded.

Sweet Vernalgrass: June 19, 30; and July 3. The greatest number was two on each of these days.

Orchard Grass: June 28; July 7, 8, 12, 15-17 and 19. The greatest number to occur was three on July 16.

Redtop: July 4, 9, 12, 15, 17, 21 and 28. The greatest number to occur were two on three of these days.

Timothy: July 7, 8, 10, 12, 13, 15-17, 19, 21, 24 and 27. The greatest number was six on July 16.

Ragweed:

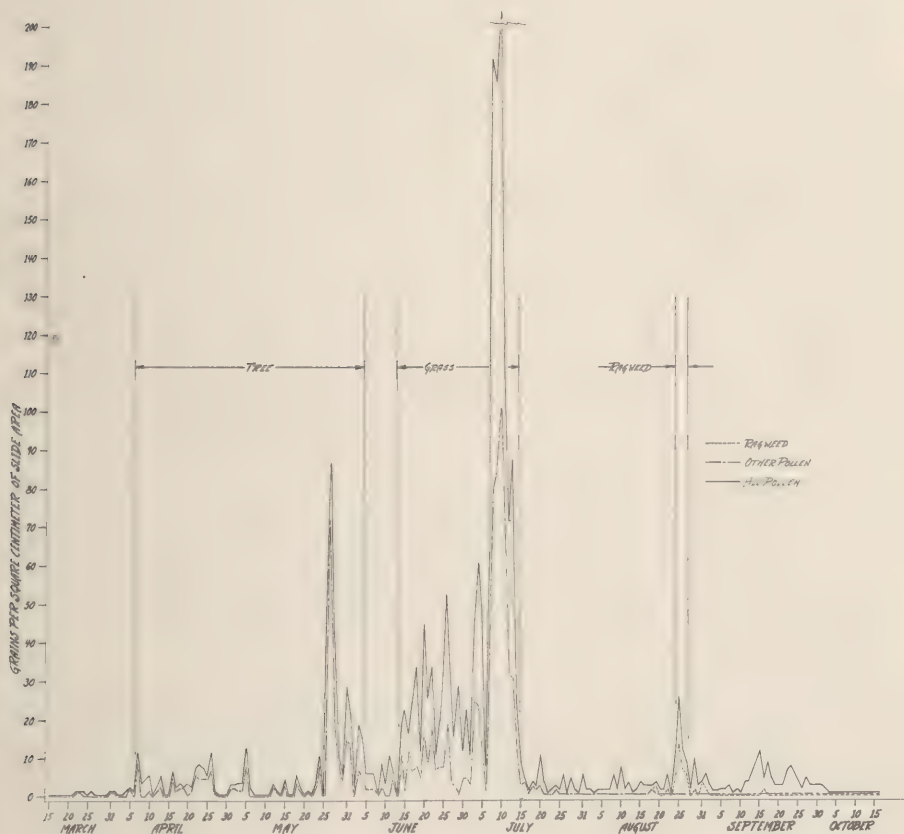
Short Ragweed: August 19-21, 25-27, 29, 31; September 1, 3, 4, 9-11 and 13-15. The greatest number to occur was thirty-eight on August 27.

Comparison of the 1948 study with the 1947 indicates the following:

Grass pollens occurred in greater numbers and species during the 1948 season. There were only three days at this station in which grass pollens occurred in such abundance as to be conducive to hayfever. Ragweed pollen occurred five days earlier in 1948 than in 1947 and in greater abundance. There were, however, only two days during this period in which Ragweed occurred in such abundance as to be conducive to hayfever.

STATION NO. 5—Warren

The following graph indicates the occurrence and density of the various hayfever pollen:



Examination of the records and graph of this station reveals the following pollen grain appearance:

Tree:

Poplar: March 22, 31; April 1, 5, 10, 12, 13, 16-19, 22, 24, 26; May 1 and 4. The greatest number occurring was four on April 16.

Birch: April 7, 21; May 5, 12, 13, 15, 18, 19, 21, 23, 24, 26-31; June 1, 3-5, 14, 15 and 17. The greatest number occurred April 7, when nine were recorded.

Oak: April 7; May 27, 28, 31; and June 4. The greatest number occurred May 27, when nineteen were recorded.

Elm: April 16, 18, 19, 22-27; May 1, 3 and 5. The greatest number occurring was five on May 5.

White Ash appeared only once, April 23, when one grain was recorded.

Maple: April 25; May 5, 24, 26-29, 31; June 1, 3 and 4. The greatest number to appear was nineteen on May 27.

Beech: May 26-29; June 3 and 4. The greatest number to appear was four on May 27.

Tree pollen appeared the following number of days in numbers sufficient to effect hayfever: Maple, 5 days; Birch, 8 days; and Oak, 1 day.

Grasses:

Sweet Vernalgrass: June 9, 12 and 16. One grain was recorded on each of these days.

Orchard Grass: June 12, 14, 16-22, 24-27; July 3-5, 7, 8 and 10-12. The greatest number to appear was five on July 3.

Canada Bluegrass: June 9 and 12, the highest count being two on June 12.

Timothy: June 14, 16-28, 30; July 1-5, 7-16, 19 and 20. The greatest number to appear was forty-seven on July 9 and 10.

Redtop: June 16-22, 24-26, 30; also July 1, 3-14, 16, 18, 20 and 24. The greatest number to appear was fifty-two on July 8.

Ragweed:

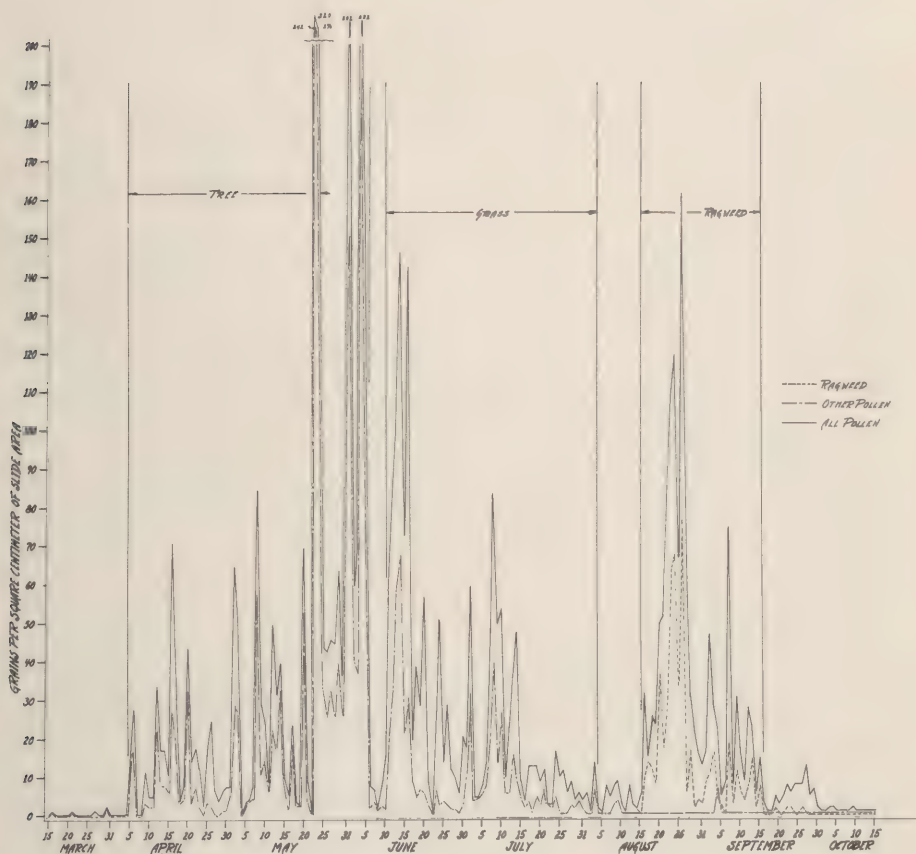
Short Ragweed: August 18, 19, 22, 24-27, 29, 31; September 1 and 16. The greatest number of grains to appear was thirteen on August 25.

Comparison of the 1948 study with the 1947 revealed the following:

There were more grass pollens appearing on the slides in 1948, but the only two occurring in such quantities as to induce hayfever were Timothy and Redtop. These occurred in a period

of about ten days, from July 4 to 13. It should be noted that the count for Timothy on one day in the 1947 survey reached 215 grains; this was caused by a nearby haying operation. It will be noted that the 1948 figures do not show this high count, possibly due to a different wind direction or haying being done before pollination.

STATION NO. 6—Lebanon



Examination of the records and graph of this station indicates the following pollen grain occurrences:

Poplar: March 16, 21, 30; April 6, 9, 10, 12, 13, 16-20, 22, 23, 25, 26; May 2, 10 and 13. The greatest number to occur was fifteen on April 20.

Elm: April 5, 6, 9, 10, 12, 13, 15-23; May 2, 3, 17, 20, 23, 25, 28; June 4 and 5. The greatest number to appear was twenty-one on April 16.

Willow appeared April 5 only, when seven were recorded.

White Ash: April 6, 13, 20; May 1, 23; June 1, 3 and 4. The greatest number to occur was four on April 20.

Birch: April 20, 25, 29, 30; May 1-3, 5-21, 23-31; June 1-5, 13, 16, 19 and 30. The greatest number to appear was seventy-four on June 4.

Maple: April 22; May 8, 10-14, 17, 20, 21, 23-29, 31; and June 1-5. The greatest number to occur was twenty-nine on May 23.

Oak: May 23-31; June 1-5 and 13. The greatest number to appear was ninety-seven on June 1.

Beech: May 23, 26-30; June 1, 3-5 and 12. The greatest number to appear was seven on June 4.

Tree pollens appeared in sufficient density to induce hayfever as follows: Elm, 6 days; Maple, 9 days; Willow, 1 day; Poplar, 5 days; Birch, 24 days; Oak, 5 days; and Beech, 2 days.

Grasses:

Timothy: June 6, 11-21, 23-27, 30; July 1-11, 14, 19 and 24. The greatest number to appear was forty-five on June 14.

Sweet Vernalgrass: June 7, 11 and 12. The highest count was five on June 11.

June Grass: June 7, 8, 10 and 11; on each of these days there was one grain recorded.

Canada Bluegrass: June 7, 9, 11-13 and 28. The highest count was four on June 11.

Orchard Grass: June 12-14, 20, 23-25; July 1, 2, 4, 5, 7-10, 12 and 14. The highest count was thirteen on July 2 and 8.

Red top: June 13-18; July 5-17 and 19-24. The greatest number to occur was twenty-three on July 8.

Ragweed:

Cocklebur: August 3, 8 and 9; the highest count being six on August 3.

Short Ragweed: August 14, 16-31; September 1-5, 7-15, 19, 22, 23 and 26. The highest count was seventy-six on August 26.

Comparison of the 1948 survey with the 1947 reveals the following:

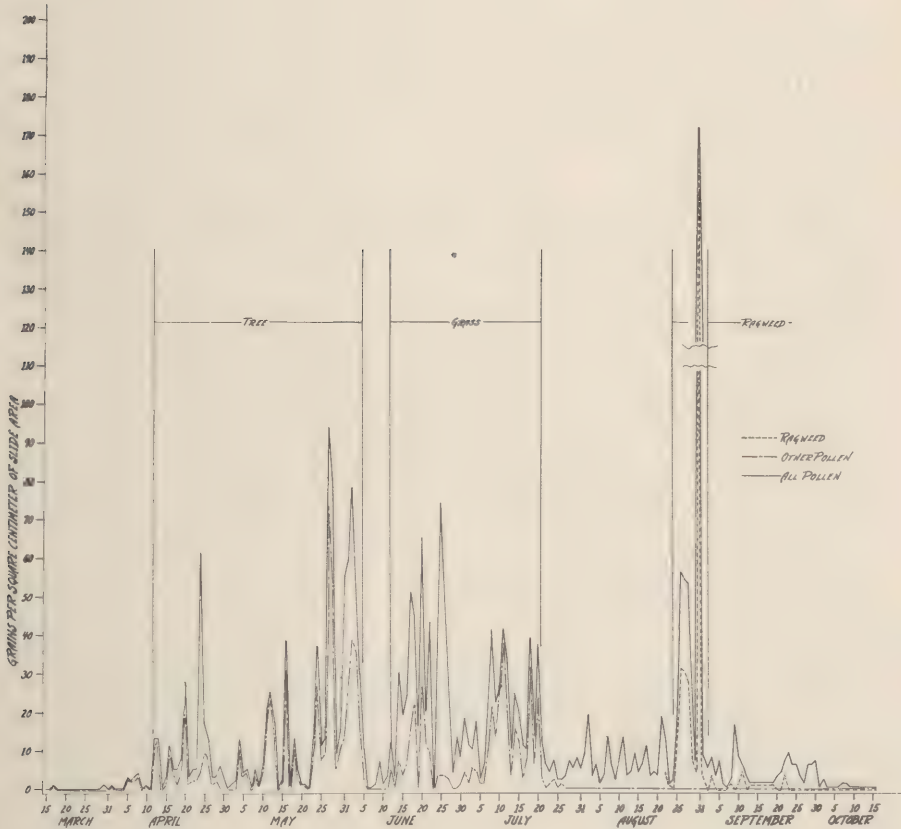
Timothy appeared on many more days and in larger numbers, but only on seven days in amounts to have effected hayfever in susceptible persons. Redtop appeared in the 1948 season and not at all in the 1947. This pollen also appeared on seven days in such amounts as to be conducive to hayfever. Ragweed appeared from August 14 to September 14 in sufficient amounts to effect hayfever. Pollen density was particularly high during the

period from August 20 to 27.

The general location of this station in 1948 was the same as in 1947. However, due to difficulty in getting personnel to change the slide daily, it was necessary to move the collecting device to a dairy on the edge of the farming district at the outskirts of town. The entire town is heavily infested with Short Ragweed in all waste areas. The 1948 figures probably are more indicative of the Ragweed hayfever conditions in this general area than the 1947 figures. It should be pointed out, however, that all pollens appeared in the 1948 season in much greater amounts than they did in the 1947 period. An explanation for this situation will be found on previous pages of this report.

STATION NO. 7—Laconia

The following graph indicates the daily densities of hayfever pollens in this location:



Examination of the records and graph for this station reveals the following appearance of pollen grains:

Tree:

Poplar: March 17; April 1, 5-8, 13, 16, 19, 21, 22, 24-28; May 19; and June 2. The greatest number appearing was eight on April 25 and 26.

Elm: April 7, 8, 10, 12, 13, 15-18, 20, 22-25, 28; May 11, 27, 28; and June 2. The greatest number was eleven on April 12 and 13.

Maple: April 20; May 12, 15, 20, 24-31; and June 1-5. The greatest number was twenty-seven on May 28.

Willow appeared only once, April 23, when one grain was reported.

Birch: May 4-6, 8-13, 15, 16, 18, 19, 21, 23-31; June 1-5, 12, 14, 15 and 22. The greatest number was thirty-seven on May 27.

Oak: May 27, 28; and June 1-4. The greatest number recorded was twelve on May 27.

Beech: May 28-30; June 1, 3 and 4. The greatest number recorded was six on June 1.

White Ash: May 28 and June 3. The greatest count was two on May 28.

The number of days tree pollens occurred in sufficient density to effect hayfever were: Elm, 4 days; Maple, 8 days; Poplar, 2 days; Birch, 15 days; Oak, 2 days; and Beech, 1 day.

Grasses:

Sweet Vernalgrass: June 12, 14-17. The greatest number occurred June 12 when three were recorded.

Orchard Grass: June 12, 16-18, 20-22 and 24; July 1-4 and 7-20. The greatest number occurring was nineteen on July 11.

Timothy: June 14, 16-18, 20-22, 24-27, 30; July 1, 4, 7-12, 14-20 and 26. The greatest number occurring was seventeen on June 18, 20 and July 10.

Redtop: July 3-15, 17-21, 23 and 24. The greatest number occurring was twenty-one on July 18.

Ragweed:

Short Ragweed: August 22, 23, 25-31; September 1, 3, 8, 10, 11, 13 and 22. The greatest number occurring was thirty-one on August 26.

There were no other hayfever inducing pollen grains seen on the slides from this area.

A comparison of the 1948 study with the 1947 indicates the following:

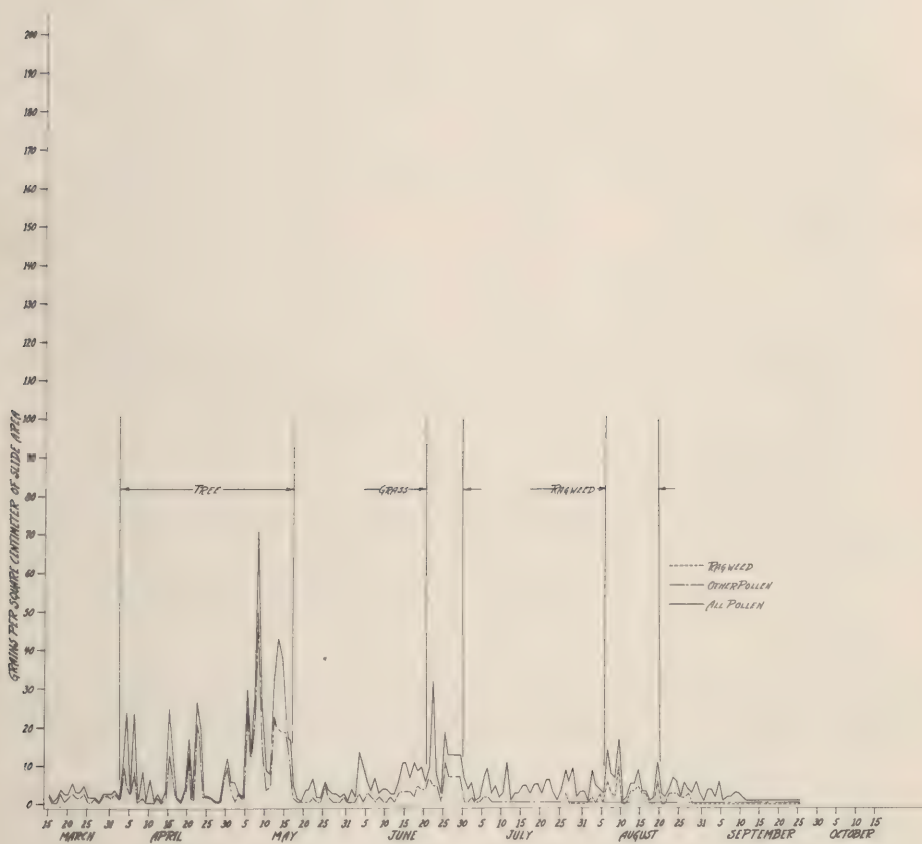
June Grass did not appear on the slides in the 1948 season.

Orchard Grass appeared a greater number of days but in much smaller quantities. There were only three days in which these pollens occurred in such amounts as to be conducive to hayfever. Other grass pollens occurred at this station in 1948, notably Timothy, which occurred on four days in amounts which would effect hayfever. Short Ragweed pollens occurred many more days during 1948. There were six days during which this pollen occurred in sufficient density to be conducive to hayfever.

Once again the climatological differences in the seasons resulted in an increase of airborne hayfever pollens.

STATION NO. 8—New London

The following graph shows the daily variation in airborne pollen densities in this area:



Examination of the records and graph for this station indicates the following pollen grain appearance:

Tree:

Poplar: April 7, 10, 11, 13, 18, 20-22, 25, 26; May 6, 12, 17, 28; and June 3. The greatest number appearing was seventeen on May 28.

Elm: April 7-9, 11, 16, 18, 23-26, 28; May 6 and 12. The greatest number was nine on April 23.

Birch: April 21; May 2, 4-7, 9, 10, 12-14, 16, 19-21, 25-29; June 1-5 and 11. The greatest number appearing was sixteen on May 13.

Maple: May 5, 9, 10, 12, 19, 21, 23-31; June 1-5 and 14. The greatest number occurring was twenty-two on May 28.

White Ash: May 11, 12; and June 3. There was only one grain recorded for any of these three days.

Beech: May 27, 28, 30, 31; June 1 and 3. The greatest number occurred May 27, when four were recorded.

Oak: May 28, 29; June 6, 14 and 15. The greatest number occurring was three on May 28.

Tree pollens were in sufficient numbers to induce hayfever as follows: Elm, 1 day; Maple, 7 days; Poplar, 1 day; and Birch, 10 days.

Grasses:

Sweet Vernalgrass appeared only once, June 14, when one grain was seen.

Orchard Grass: June 25; July 3-5, 8, 9, 11, 12 and 16. The greatest number occurring was two on July 11 and 12.

Canada Bluegrass appeared once, on June 19, when one grain was recorded.

Timothy: June 23, 25, 26, 28; July 1, 3-5, 7-13, 15-19, 22, 25 and 26. The greatest number appeared July 15, when ten were recorded.

There were no other grass hayfever pollens recorded at this station.

Ragweed:

Short Ragweed: August 15, 22, 24, 26-29; September 1-5, 8 and 11-16. The greatest number appeared August 29, when nine were recorded.

A comparison of the 1948 study with the 1947 revealed the following:

The pollen of Orchard Grass appeared on the same number of days and in the same quantities in both years. Timothy appeared a greater number of days, but on only two in sufficient numbers to have effected hayfever. The pollen of Short Rag-

The same increase in quantities and occurrences in pollen is to be seen at this station, where the increase in the 1948 study is marked. It should be noted, however, that while the pollen appeared more frequently, the number of days in which it appeared in sufficient density to have effected hayfever in sensitive individuals is approximately the same.

The following graph shows the daily density and character of pollen for this station:



From the records and graph made of pollen grain concentrations at this station, the following can be educed:

Tree:

Poplar: March 24, 26, 30; April 2, 4, 5, 7-10, 12, 13, 16, 20, 22, 23, 25; and May 2. The greatest number occurred April 5, when sixty-two were seen.

Birch: March 31; April 5; May 3-5, 8-10, 12, 13, 15, 18-24, 26-28, 30, 31; June 2-6, 13, 21 and 25. The greatest number to appear was ninety-one on May 18.

Maple: April 4-6, 8, 9, 12, 13, 20, 28; May 2, 4, 5, 9, 12, 15, 18, 20, 24, 26-31; June 2-6 and 16. The greatest number occurring was thirty-two on May 31.

Elm: April 5-13, 15, 16, 19, 20, 22-25; and May 1. The greatest number to appear was 112 on April 5.

Willow: April 6, 8; and May 2. The greatest number occurred on April 8, when four were recorded.

Beech was seen once, May 5, when one grain was recorded.

White Ash: May 9, 10, 12, 13, 18, 24, 29 and 31. The greatest number was recorded May 10, when four were seen.

Tree pollens were recorded in quantities to induce hayfever as follows: Elm, 7 days; Maple, 9 days; Poplar, 7 days; Birch, 11 days; and Oak, 1 day.

Grasses:

Sweet Vernalgrass: July 7-9. The highest count on any one day was two.

Timothy: July 1, 3, 7-9, 12-14, 16, 21, 22 and 24. The highest count was July 8, when nine were recorded.

Orchard Grass: July 3, 6, 8, 9, and 13. The highest count was five on July 8.

Redtop: July 7-9, 13, 16, 21 and 23. The highest count was July 8, when four grains were reported.

Ragweed:

Short Ragweed: August 14, 20, 23-26, 29-31; September 1, 2, 8, 10, 12 and 13. The highest count was fifteen, recorded August 25.

A comparison of the 1948 survey with the 1947 revealed the following facts:

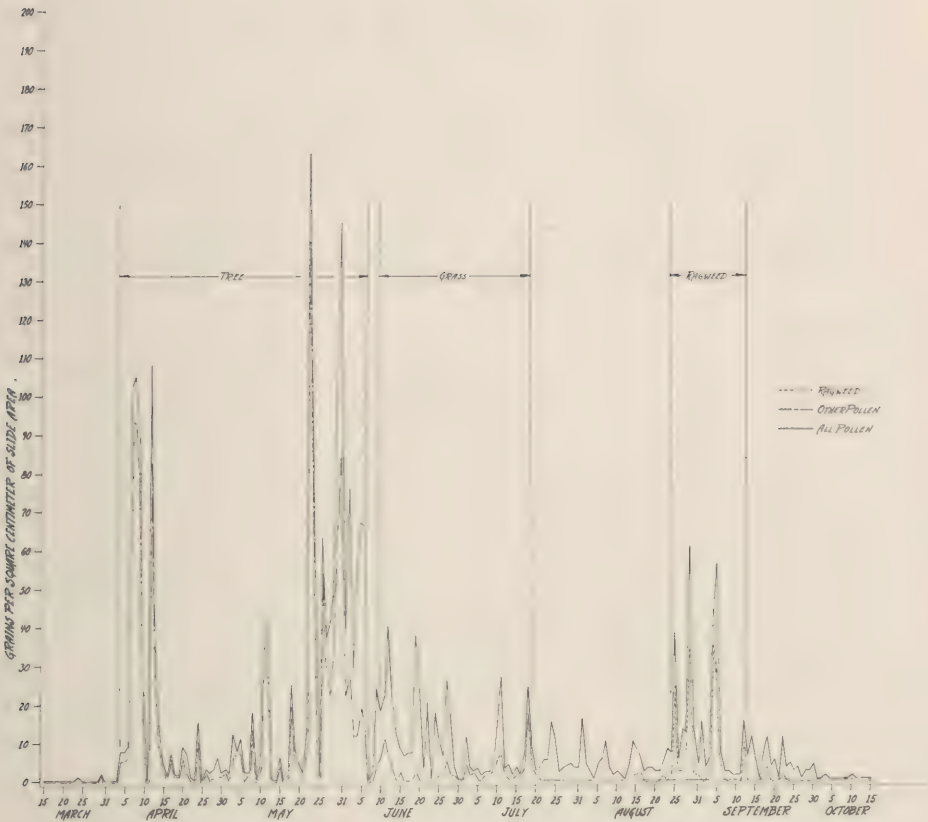
Grass pollens appeared on more days but the quantity of pollen grains which occurred was not significant. Timothy occurred on more days but on only one in amounts sufficient to effect hayfever. The pollen of Short Ragweed occurred at this station on the same number of days and in about the same density

as it appeared in the 1947 study. There were only three days in which it occurred in such density as to be conducive to hay-fever.

The area in and around this station evidently had approximately the same growths as it had the previous year. The influences which increased pollens throughout the State is not evident from these figures, even though the collecting device was maintained in the same spot as during the 1947 survey.

STATION NO. 10—Keene

The following graph indicates the density and occurrences of the various pollens being studied:



Examination of the records and graph of this location indicates the following pollen grain occurrences:

Tree:

Poplar: March 30; April 6-9, 12, 13, 17; and May 8. The greatest number occurred April 9 and 12, when four were recorded.

Elm: March 30; April 4, 6-10, 12-21, 24, 25, 28-30. The highest counts were April 7 and 12, when ninety-three were seen.

Maple: April 4, 20; May 11, 22-31; and June 1-3. The highest count recorded was 100 on May 22.

Willow: April 24, when one grain was recorded.

Birch: April 18, 21; May 1, 3-5, 7, 8, 10, 11, 15, 17-20, 22-24, 26-31; June 1-6, 9, 15 and 19. The highest count recorded was seventy-seven on May 11.

White Ash: May 18 and 27. On both of these days there was one grain counted.

Oak: May 26-31; June 1-6 and 11. The greatest number recorded was twenty-two on May 31.

Beech: May 27, 31; June 4, 5 and 6. The greatest number was nine on May 31.

Tree pollens appeared the following number of days in numbers sufficient to effect hayfever: Elm, 9 days; Maple, 8 days; Birch, 21 days; Oak, 6 days; and Beech, 1 day.

Grasses:

June Grass: June 9-13. The greatest number was recorded June 10 and 11, when three were seen.

Sweet Vernalgrass: June 10-13 and 19. The greatest number recorded were four on June 11.

Canada Bluegrass occurred June 10-13. The highest count was three on June 11.

Orchard Grass: June 25, 27, 29; July 2, 7, 9-11 and 18. The greatest number recorded was July 18, when four were seen.

Timothy: June 26-28; July 2-4, 7, 9-12 and 15-19. The greatest number occurred July 18, when seven were seen.

Redtop: July 17-20. The highest count was six on July 18.

Ragweed:

Short Ragweed: August 14-16, 22, 24-31; September 3-6, 12, 17, 18 and 22. The highest counts recorded were thirty-five on August 29 and September 4.

A comparison of the 1948 study with 1947 revealed the following:

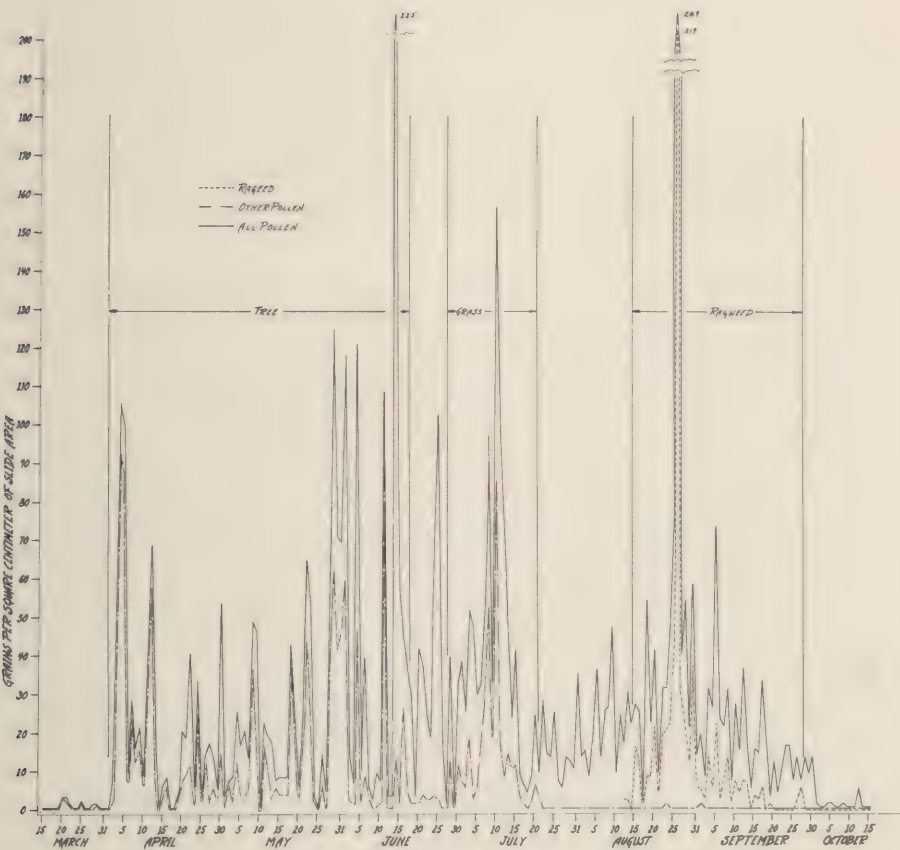
Timothy pollen occurred on less days and in smaller quantities

than it did in 1947. Other grass pollens appeared in 1948 which did not appear in 1947. They did not, however, appear in sufficient quantities to induce hayfever. Short Ragweed occurred on two more days in 1948 than in 1947. The count exceeded the estimated limit for inducing allergenic reactions on twice as many days in 1948 as it did in 1947.

It has been stated previously that the 1948 season was much better suited to the production of pollen of the various species and genera of plants under consideration than in 1947. The difference at this station between the two years is not startling enough to warrant any particular comment.

STATION NO. 11—Exeter

The following graph indicates the density and occurrence of the various pollen being studied:



Examination of the graph and records for this location indicates the following pollen grain appearance:

Tree:

Elm: March 20; April 3-13, 15, 16, 21, 22, 24-26, 28; May 2 and 20. The highest count was recorded April 4, when eighty-five were seen.

Maple: April 16, 19, 20, 24-26, 28, 30; May 2-5, 6-9, 11, 13, 20, 22, 23, 28, 29, 31; June 1, 10, 11, 14, 16 and 17. The highest count recorded was 103 on June 11.

Birch: April 24, 27-30; May 4, 5, 7-9, 11-15, 18, 19, 22-24, 26, 28-31; June 1, 2, 4-6, 14, 16 and 20-25. The greatest number recorded was forty-four on June 1.

Oak: April 28, 30; May 5, 6, 8, 11, 12, 21-24, 26, 28-31; June 1, 3, 4, 6, 7, 11, 14-17, 21 and 24. The greatest number recorded was forty-two on May 29.

Beech: May 12, 22, 28, 30; June 1, 2, 4, 6, 14, 17-19 and 21. The greatest number recorded was ten on June 4.

White Ash: May 8, 11, 12, 18, 21-24, 28-30; June 1 and 5. The greatest number recorded was May 22, when twelve were seen.

Tree pollens appeared on the following number of days in quantities to effect hayfever: Elm, 10 days; Maple, 6 days; Poplar, 4 days; Birch, 14 days; Oak, 8 days; Beech, 2 days; and White Ash, 3 days.

Grasses:

Sweet Vernalgrass: June 28 and 30. The highest count was June 28, when three were recorded.

Orchard Grass: June 28, 30; July 1-3 and 5-10. The greatest number being recorded was eight on July 6 and 10.

Sorrel Dock was seen on only one day, July 2, when two grains were recorded.

Canada Bluegrass: June 28, 30; July 1 and 7. The highest count was recorded on June 30, when seven were seen.

Timothy: June 28; July 1-17, 19-21. The highest number recorded was eighty-three on July 10.

Goldenrod: One grain was seen August 23 and September 1.

Ragweed:

Short Ragweed: August 12, 13, 15-31; September 1-13, 15-17, 19, 26 and 27. The greatest number reported was 219 on August 26.

A comparison of 1948 with the 1947 survey reveals the following:

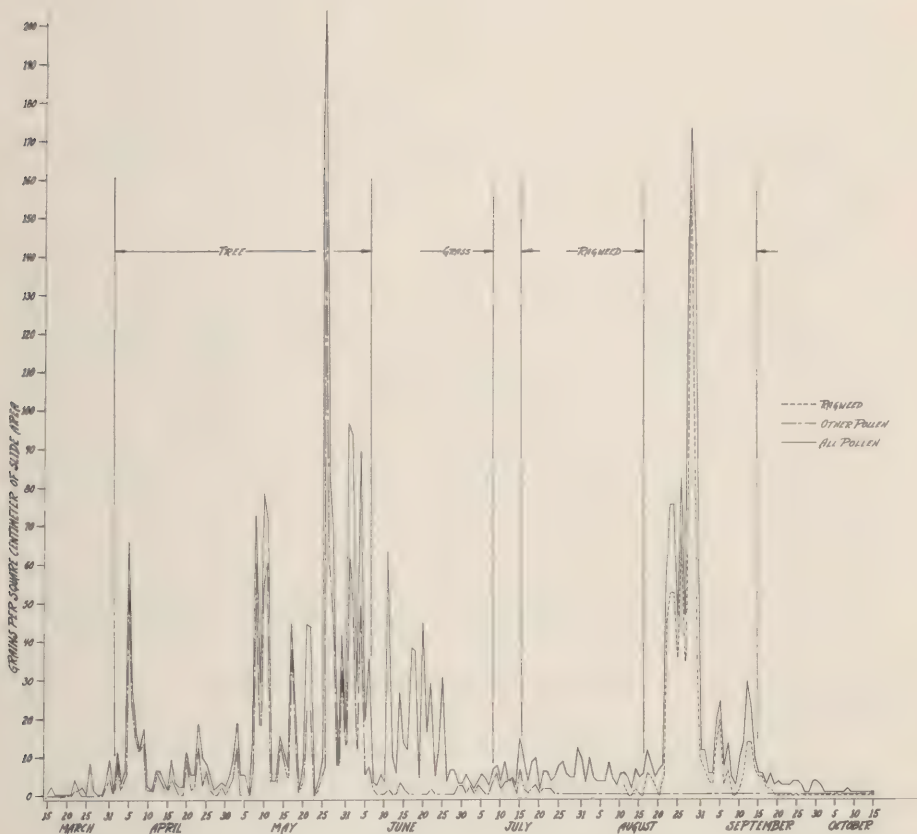
The pollen of Timothy appeared on more days in 1948 than in 1947; there were eleven days in which this pollen occurred in sufficient density to induce hayfever. There were other species

of grass pollens occurring in 1948 that did not occur in 1947; the principal one being Orchard Grass, which occurred on five days in sufficient density to effect hayfever. Short Ragweed pollen appeared on fifteen more days in 1948 than in 1947. This pollen appeared on eighteen days in sufficient density to effect Ragweed hayfever.

The figures from this station once again bear out the conclusion that the 1948 hayfever season was such that the development and dispersion of pollen through windborne agencies was much greater than in the 1947 season.

STATION NO. 12—Nashua

The following graph indicates the density and occurrence of hayfever pollens at this location:



From the records and graph of this station, the following pollen grain information can be educed:

Tree:

Poplar: March 22, 23, 30, 31; April 1, 2, 5, 7-9, 12, 16, 17, 20 and 23-25. The greatest number were recorded on April 2, when seven were seen.

Birch: April 2, 20, 22, 23, 29; May 1-3, 7-12, 14-21, 25-31; June 1-6, 11; and July 16. The greatest number recorded at any time was sixty-two on May 8.

Elm: April 3-17, 20, 21, 23, 25 and 26; and May 21. The highest count recorded was fifty-eight on April 5.

Maple: April 5, 20, 22, 23; May 8-11, 20, 21, 24, 26, 27; June 1, 2 and 14. The greatest number recorded was five on April 20 and June 1.

White Ash: One grain was recorded April 6.

Oak: May 16, 21, 25-31; June 1-4, 6 and 22. The greatest number recorded was 157 on May 26.

Beech: May 27; June 1, 2, 5-7, 14 and 15. The greatest number recorded was two on each of four days.

Tree pollens appeared on the following number of days in numbers sufficient to induce hayfever: Elm, 2 days; Poplar, 1 day; Birch, 18 days; and Oak, 8 days.

Grasses:

Sweet Vernalgrass: Two grains were seen on June 29.

Canada Bluegrass: Two grains reported on June 29.

Orchard Grass: July 2, 4, 8, 9 and 12. There were two grains recorded on four of the five days.

Timothy: July 5, 8-11, 13 and 23. The greatest number recorded was four on July 9.

Redtop: July 11-13, 15, 18, 19 and 21. The highest count was made July 15, when six were observed.

Ragweed:

Short Ragweed: August 11, 14, 17-19, 21-31; September 1-7 and 10-18. The highest count was recorded August 29, when 158 were seen.

A comparison of the 1948 study with the 1947 reveals the following:

The grass pollens occurred in more variety and on a greater number of days in the 1948 season than the 1947, but at no time did they exceed the count estimated as that necessary to effect hayfever. Short Ragweed pollen occurred on twice as many days in 1948 as in 1947. The density was such that on seventeen of the days which Ragweed pollen did occur, it was sufficient to induce hayfever in allergic individuals.

The following collecting stations were operated only during the 1948 season; therefore, there can be no comparison with previous figures from these areas. There is presented a brief and general description of the physical characteristics of the area surrounding each station.

The following graph indicates the density and frequency of airborne pollen at this site:



This location is approximately 14 miles south of the Canadian border at the extreme northern tip of New Hampshire, and 8 miles east of the border at that side of New Hampshire. The entire area is heavily forested with the Spruce-Fir timber type, with an admixture of Birch and other hardwoods. The surrounding land is wilderness, dotted with large glacial-type lakes. One road goes through this country, near which the pollen collection device was maintained. The main industry is logging, with some small farming in the valley beside the Connecticut River.

Light growths of Short Ragweed were found as far north as Perry Stream, approximately two miles southwest of the Dam. These growths continued beside the main highway down to and below the settlement of Pittsburg. This region lends itself most readily to the complete control of this obnoxious plant.

An examination of the graph at this station indicates the following pollen grain appearance:

Tree:

Poplar: March 15, 21, 31; April 5, 15, 18, 22, 24-27; May 3, 5, 6 and 11. The greatest number occurring was four on April 26.

Willow appeared once, April 13, when one grain was seen.

Elm: April 22; May 3-6; and July 1. The greatest number occurring was three on May 4.

Birch: May 4-6, 15, 16, 18, 19, 21, 24-28, 30, 31; June 1-8, 14, 20-22, 24, 30; July 7 and 17. The greatest number appeared May 30, when forty-eight were recorded.

Maple: May 5, 27, 28; and June 6. The greatest number occurring was three on May 28.

Oak: May 24, 27, 30; June 4, 16; and July 9. The greatest number appeared on May 30, when five were seen.

Beech: May 28, 31; June 1-5, 7, 8, 14, 18; and July 1. The greatest number appeared May 28, when five were seen.

Grasses:

Orchard Grass: July 3, 4, 7-9, 11, 12, 15, 17, 21 and 25. The greatest number occurring were twenty-four on July 9.

Timothy: July 3, 4, 8, 9, 11, 12 and 15-17. The greatest number appearing was forty-one on July 11.

Redtop: July 8, 9, 11-18, 20, 21, 24 and 25. The greatest number occurring were 111 on July 11.

These were the only times in which grass hayfever pollens appeared.

Ragweed:

Short Ragweed: August 25-29; September 3, 10 and 12. The greatest number appearing were five on August 25 and 28.

Examination of the graph will reveal that the only tree pollen

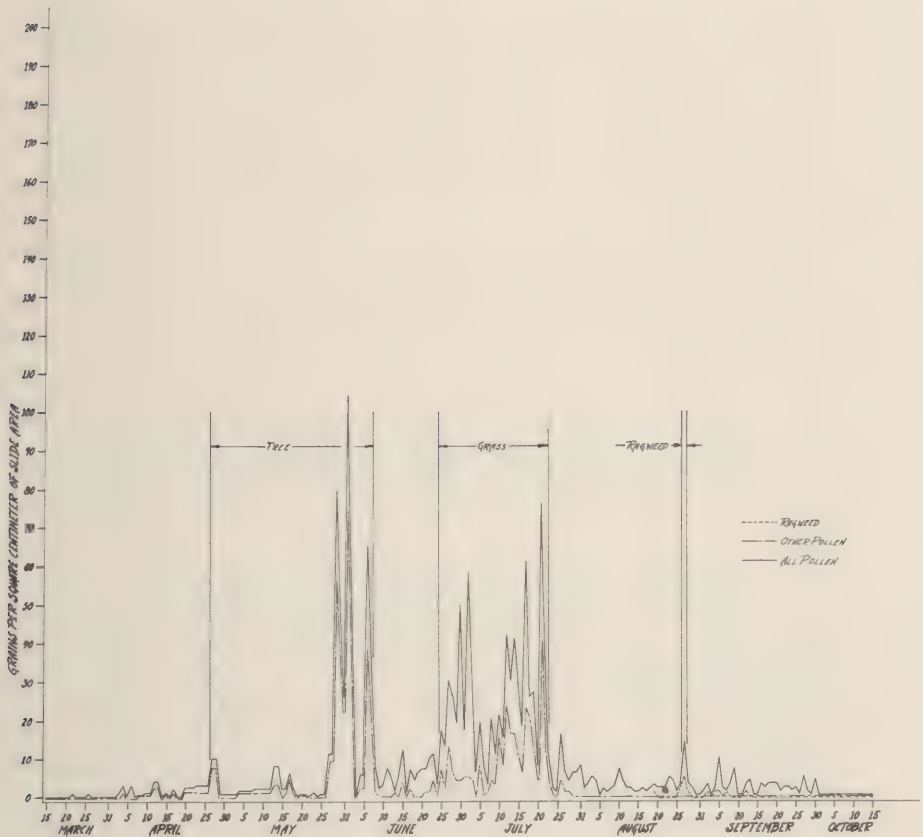
occurring in numbers sufficient to effect hayfever was Birch on eight days during the latter part of May and the first of June.

Orchard Grass pollen appeared one day; Timothy two days; and Redtop three days in numbers sufficient to induce hayfever.

Short Ragweed did not occur at any time in sufficient numbers to induce hayfever in susceptible persons.

STATION NO. 14 was located in the Township of Errol, at an altitude of 1,250 feet. This station was maintained at the home of Mr. H. Hurlbert, Conservation Officer of the New Hampshire Fish and Game Department.

The following graph indicates the occurrence and densities of the various pollens:



Errol is a small town on the Androscoggin River in which the roads to Dixville Notch, Umbagog Lake, Thirteen Mile Woods and the Magalloway country junction. The principal industry is logging, together with some small farming in the river valley. The entire area is heavily wooded with the Spruce-Fir and mixed hardwoods timber type. The surrounding terrain is mountainous. The growing season is short, due to the surrounding mountains and northern latitudes.

Short Ragweed was found by the reconnaissance survey to occur in light growths along the various roads immediately adjacent to the Town of Errol. All highways within a mile or two of this town are so heavily wooded and shaded that no Ragweed was found at any time on the reconnaissance survey.

Examination of the data at this station indicates the following pollen grain occurrence:

Tree:

Poplar: April 4, 12-15, 20, 23, 27, 29; and May 13. The greatest number recorded was three on April 13.

Elm: April 8, 10, 12, 17, 20, 23, 27; May 4, 8, 13 and 27. The greatest number occurring was four on April 27 and May 4.

Birch: May 8, 13, 16-18, 20, 27, 29-31; June 1, 2, 4, 6-8, 15, 17, 21-23 and 25-28. The greatest number occurring was seventy on June 1.

Beech: May 27, 29, 31; June 1, 2, 4, 6, 13 and 25. The greatest number occurring was nineteen on June 6.

Maple: May 29 and 31. The greatest number of grains was fifteen on May 29.

White Ash: One grain was seen on June 13.

The only tree pollens occurring in sufficient numbers to effect hayfever were Poplar on April 27; Birch on eight days in the latter part of May and the first of June; and Beech on June 6.

Grasses:

Orchard Grass: June 25, 27-30; July 8 and 10-22. The greatest number recorded was thirty-five on July 21.

June Grass: July 1, 2 and 3. The greatest number of grains recorded was five on July 2.

Canada Bluegrass: July 1 and 3, for a count of one grain each day.

Redtop: July 1, 3, 5, 7-23 and 26-28. The greatest number was recorded on July 12, when seventeen were seen.

Timothy: July 5, 8-10, 12-21 and 23. The greatest number appeared July 12 and 13, when five were seen.

June Grass occurred on one day, Orchard Grass on four days, and Redtop on five days in sufficient numbers to induce hayfever.

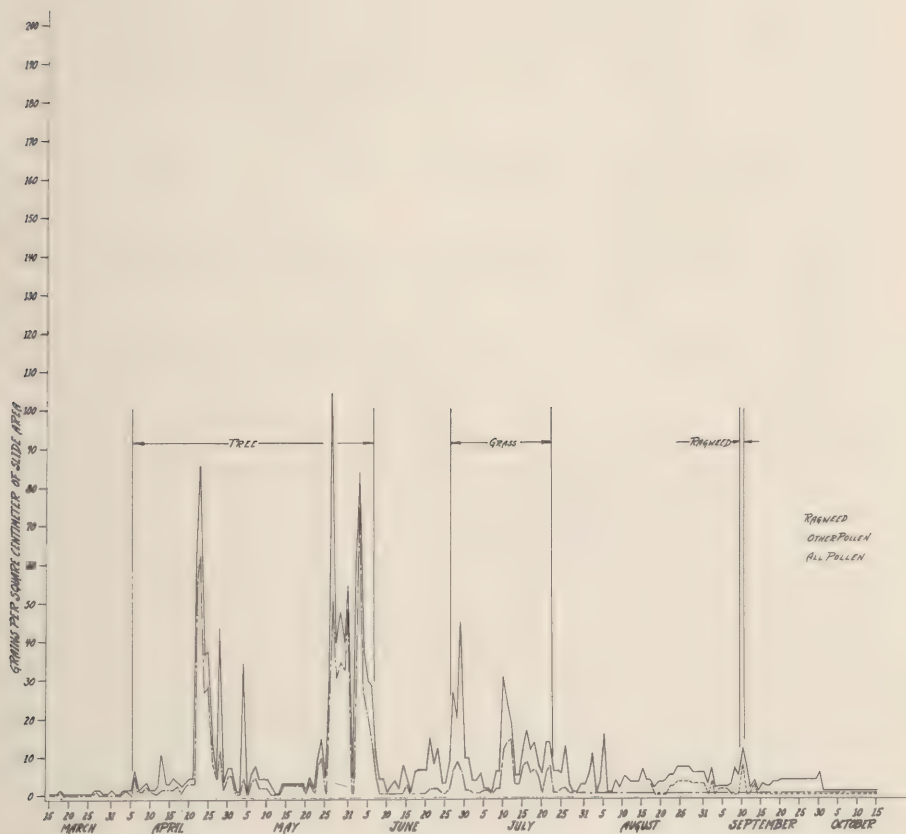
Ragweed:

Short Ragweed: August 19, 26-28; September 2, 4, 5, 7 and 12. The greatest number occurring was five on August 27.

Ragweed pollen, in this general area, did not occur at any time in sufficient quantities to induce hayfever in susceptible persons.

STATION NO. 15 was located in Groveton at an elevation of 950 feet. The collecting device was in the yard of Dr. R. Hinkley, the local health officer, and was supervised by him throughout the season.

The following graph indicates the occurrence of the various pollens during the season:



Groveton is on the edge of the Connecticut River Valley, at the junction of the Ammonoosuc River and the Connecticut. The area north and south in the Connecticut Valley, and to some extent on the east in the Ammonoosuc Valley, is extensively farmed. The acreage outside the river valley is heavily timbered with the predominating Spruce-Fir type, mixed with the various hardwoods. The principal industry in Groveton is paper manufacturing, raw products for which come from the surrounding hills. The growing season is short, but pollens carried by winds up and down the Connecticut Valley would effect the people in this area.

The pollen device had a southwestern exposure, and was somewhat shielded by the house of the local health officer. Other than this slight shielding, there was no interference with the collecting device for at least a hundred feet in any direction.

An ocular survey of the surrounding area indicated the occurrences of Ragweed plants in such amounts as to be listed as medium growths. Extensive growths occurred principally alongside the main highways, throughout the pulp mill yard, and beside the streets of the town. This town is on the northwestern corner of the experimental Ragweed control area discussed further on in this report.

An examination of the graph and records indicates the following pollen grain appearance:

Tree:

Poplar: March 18, 27; April 3, 6, 13, 16, 17, 19, 20, 23-26, 30; May 4, 6, 8, 14; and June 15. The greatest number occurring was eight on April 23.

Birch: April 6-10, 14, 19, 22-25; May 7, 14, 18, 21, 23-31; June 2-7, 21, 22, 26 and 27. The greatest number appearing was fifty on June 3.

Elm: April 6, 22-30; May 4, 7 and 8. The greatest number occurring was fifty-three on April 23.

White Ash: April 22, 24; May 6; and June 3. The greatest number was two on June 3.

Maple: April 3; May 6, 28-31; June 2-5 and 7. The greatest number occurring was ten on May 29.

Oak: May 28 and June 27. One grain was recorded on each of these days.

Beech: May 27, 30, 31; June 2-6 and 15. The greatest number was seventeen on June 3.

The only tree pollens occurring in sufficient densities to induce hayfever were Elm on 6 days; Poplar on 2 days; Maple on 1 day; Birch on 14 days; and Beech on 1 day. This period occurred the latter part of May and the first of June.

Grasses:

June Grass: June 23 and 27-30. The greatest number occurring was eight on June 28.

Redtop: June 29; July 10-13, 15-19, 21, 22 and 26. The greatest number occurring was seven on July 10.

Orchard Grass: July 5, 8, 11-13, 15-17, 19, 21, 22 and 25. The greatest number occurred July 12, when eight were seen.

Timothy: July 8, 10-12, 15-19, 21 and 22. The greatest number was recorded July 15, when five were seen.

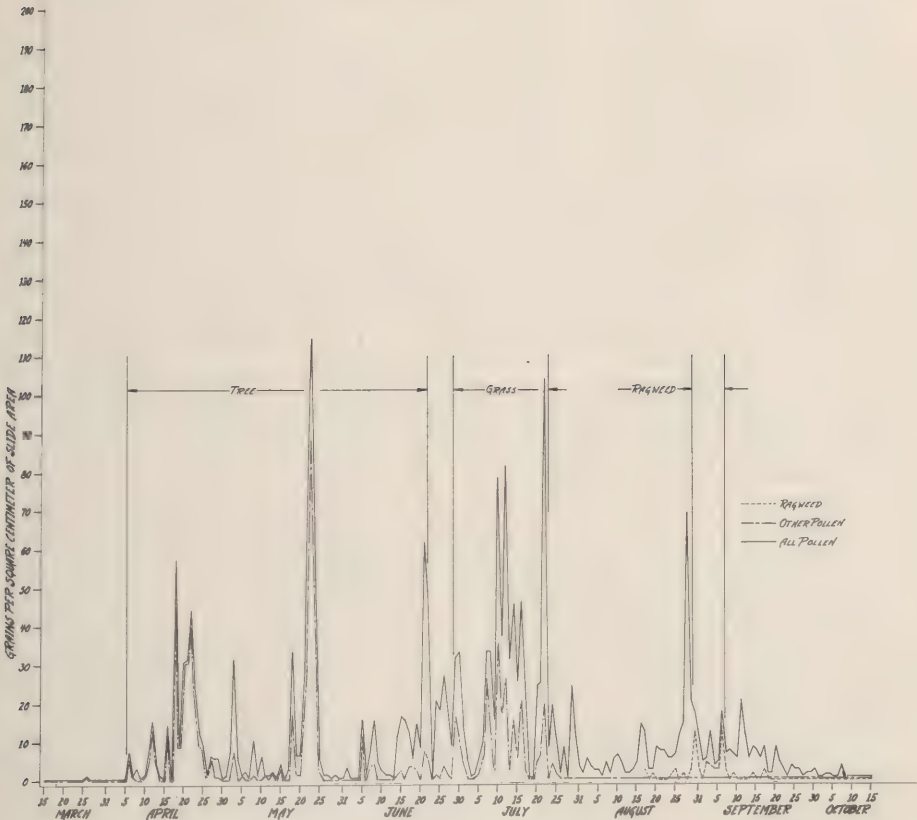
Grass pollen occurred in densities sufficient to induce hay-fever as follows: June Grass, 1 day; Orchard Grass, 2 days; Timothy, 1 day; and Redtop, 1 day.

Ragweed:

Common Ragweed: August 17, 22-31; September 2, 4-6, 10 and 13. The greatest number were recorded September 10, when seven were seen. September 10 was also the only day in which Ragweed occurred in sufficient density to induce hayfever.

STATION NO. 16 was located in the Town of Bath, at an altitude of 500 feet. The collecting device was in the yard of Mr. W. H. Chase, the local health officer, and maintained by him throughout the season.

The following graph indicates the occurrence of various pollens during the season:



The Town of Bath is in the lower Ammonoosuc River Valley about four miles east of the Connecticut Valley. The town is situated at the western boundary of the White Mountain National Forest. The surrounding area is heavily timbered with Spruce-Fir, White Pine and mixed hardwood. The terrain varies from rolling to rugged, and is farmed heavily in the Connecticut River Valley and the lower Ammonoosuc Valley on both sides of the town.

The pollen device was open to the wind from all directions excepting the northeast, where it was partially shielded by the home of the health officer. There was nothing to interfere with wind movement for 300 feet in other directions.

An ocular survey of the surrounding area indicated moderate to heavy growths of Ragweed. These occurred beside the main highways, in the waste areas in the town and to some extent around the edges of gardens.

An examination of the graph and records indicates the following pollen grain appearance:

Tree:

Poplar: March 26; April 6, 11-13, 16, 21, 22, 24, 25, 27, 28; May 3 and 5. The greatest number occurred April 12, when thirteen were recorded.

Elm: April 6, 7, 10, 11, 16, 18-27; and May 3. The greatest number occurred April 18, when fifty-six were recorded.

Birch: April 13; May 8, 11, 13, 15, 18-25; June 5, 7, 8, 15, 17-19, 21, 22 and 24. The greatest number occurred May 22, when forty were recorded.

Maple: April 25; May 22, 23; June 7, 8 and 21. The greatest number occurring was fifty-two on May 23.

Willow: One grain was recorded on May 21.

Oak: May 23 and 24, one grain occurring each day.

Beech: May 22-24; June 14 and 22. The highest count was five on May 23.

Elm pollen occurred in sufficient quantities to effect hayfever on 8 days; Poplar on 2 days; Maple on 2 days; and Birch on 6 days. These were the only tree pollens occurring in densities sufficient to induce hayfever.

Grasses:

June Grass: June 26, 27, 29, 30; and July 1. The greatest number occurring was nine on June 29.

Canada Bluegrass: June 29, 30; and July 1. The highest count occurred June 29, when six were seen.

Redtop: June 29; July 1, 8, 10, 13, 14, 16, 17, 20-22, 24 and 25. The greatest number occurred July 22, when fourteen were recorded.

Orchard Grass: July 5-8, 10-17 and 20-22. The greatest number occurred July 10, when thirty-one were seen.

Timothy: July 6-12, 14-16, 21 and 22. The highest count was on July 8, when ten were seen.

June Grass occurred one day in sufficient quantity to induce hayfever: Orchard Grass, 4 days; Timothy, 2 days; and Redtop, 2 days.

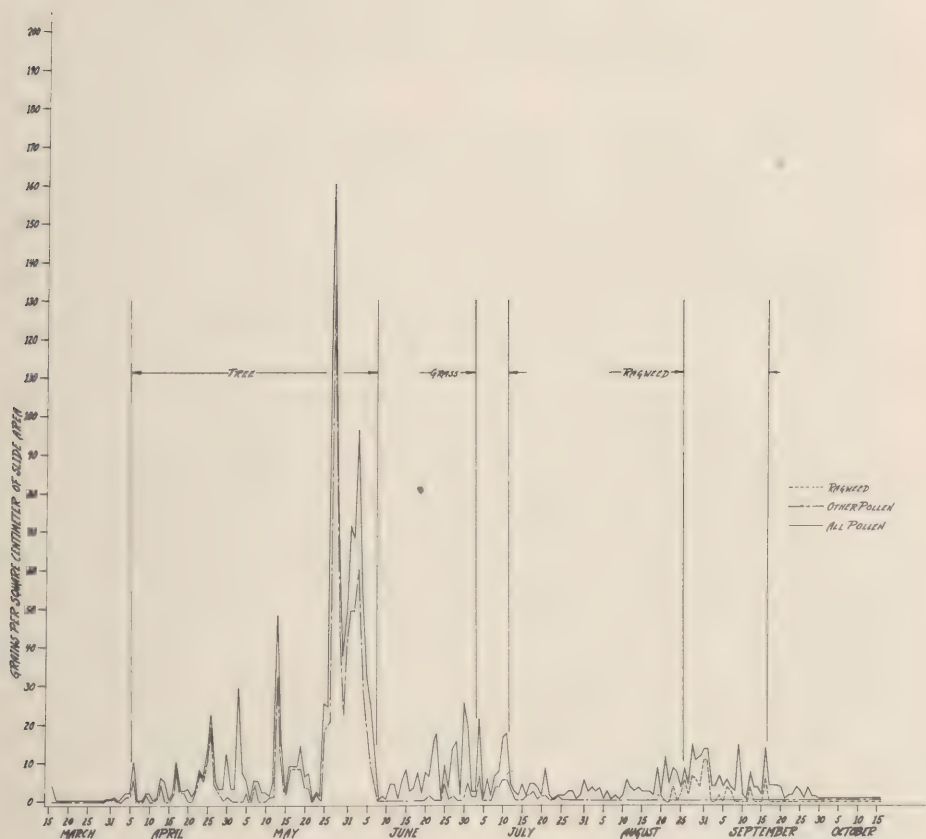
Ragweed:

Short Ragweed: August 17, 19, 24, 25, 27, 29-31; September 2-7, 9, 14 and 17. The highest count was thirteen on September 6.

There were only two days at this station in which Ragweed pollen occurred in sufficient abundance to induce hayfever in susceptible individuals.

STATION NO. 17 was located in Lincoln, at an elevation of 800 feet. The collecting device was maintained by Mr. R. Sinclair at his home, and was open to wind movement on all sides.

The following graph indicates the occurrence of the various pollens during the season:



Lincoln is situated on the banks of the East Branch of the Pemigewassett River, about a mile from the main Pemigewassett Valley. The town is entirely surrounded by the White Mountain National Forest. The only industry is a pulp and saw mill utilizing the various forest products. The surrounding roads and land are devoted largely to recreation, as the town is situated nearly in the heart of the White Mountain region. Immediately north is Franconia Notch, site of the Old Man of the Mountains, the Flume, and the Tramway. These valley roads have the heaviest recreational travel of any in the State.

Ragweed was noted in densities from light to medium along the main highway and streets of the town, and in the yard and railroad tracks of the pulp mill. This area is one in which a small expenditure of effort and money would control all of the Ragweed now existing. The Waterville Valley, immediately below this town, is reached by a road traversing completely through dense forest, along which no Ragweed was seen. The recreational area at the end of this road supported a few scattered, light patches of Ragweed. One man in one day could control this infestation and create a completely Ragweed free area.

An examination of the graph and records indicates the following pollen grain appearance:

Tree:

Poplar: March 29, 31; April 3, 11, 12, 15-17, 21, 22, 24, 25, 27 and 29. The greatest number recorded was seven on April 25.

Birch: April 4, 24; May 4, 6, 10-15, 18-20, 22, 24-31; and June 1-6. The greatest number occurring was eighty on May 26.

Elm: April 5, 8, 12, 13, 15-17 and 22-26. The greatest number occurring was eight on April 24.

Maple: April 25; May 15, 24, 26-28, 30, 31; and June 1-4. The highest count occurred May 27, when forty-two were recorded.

White Ash: April 21; May 27; and June 2. The highest count was recorded May 27 when five were seen.

Willow: One grain was observed April 26.

Oak: May 27, 28, 31; June 1-4 and 20. The greatest number appeared May 28, when twenty-three were seen.

Beech: May 26-31; and June 1-6. The greatest number recorded was eight on May 31.

Tree pollens occurred in densities sufficient to effect hayfever as follows: Elm, 2 days; Maple, 2 days; Willow, 1 day; Birch, 17 days; Oak, 3 days; and Beech, 5 days.

Grasses:

June Grass: June 24, 26 and 30. The highest number recorded was four on June 30.

Canada Bluegrass: One grain was seen on June 24.

Sweet Vernalgrass: July 1 and 3, the highest count being two on July 3.

Timothy: July 3, 7-11 and 23, the highest count being four on July 3 and 10.

Orchard Grass: July 7-10, 15, 19 and 20, the highest count being two on July 8 and 9.

According to the information given in this report, the area in and around Lincoln is comparatively free of the pollens of grasses which would induce hayfever.

Short Ragweed: August 18, 19, 22, 24-31; September 3, 5, 6, 11 and 15. The highest count was ten on August 30 and 31.

These figures indicate that the area around Station No. 17, with the exception of a few days in the spring and fall, is free of hayfever inducing pollen.

The following graph indicates the occurrence of the various pollens during the season:



Holderness School is situated on a hill overlooking the winding Pemigewassett Valley, a mile east of the Town of Plymouth. The area to the north and west is the White Mountain National Forest, south are the hills between Winnepesaukee and Newfound Lakes, and east is the Squam Lake district. General farming along the Pemigewassett Valley and its tributaries, as well as industry in Plymouth, are the means of livelihood. Surrounding timber types are White Pine and mixed hardwoods, with Spruce-Fir in the mountains.

Examination of the graph and records indicates the following pollen grain occurrence:

Tree:

Poplar: March 21, 30, 31; April 1, 4, 5, 13, 16, 18-20, 23, 25, 27 and 30. The highest count occurred April 25, when ten were recorded.

Elm: April 16, 17, 19-28 and 30. The highest count occurred April 19, when eighty-two were recorded.

Maple: April 27, 29, 30; May 27-30; June 1-6, 12 and 15. The greatest number occurred June 2, when twelve were recorded.

Birch: May 3, 7, 12-15, 17-19, 22-31; June 1-6, 11, 19, 23, 26; and July 4. The highest count occurred June 2, when twenty-nine were recorded.

Beech: May 25-27, 29-31; and June 2-7. The highest count occurred June 2, when six were observed.

Oak: May 27-29; June 2-6 and 9. The greatest number occurred June 9, when thirty-four grains were observed.

The pollens of trees occurred in sufficient quantities to induce hayfever on the following number of days: Elm, 7 days; Poplar, 1 day; Maple, 2 days; Birch, 12 days; Oak, 4 days; and Beech, 1 day.

Grasses:

June Grass: June 26, 27; July 2 and 4, the highest count being thirteen grains on June 27.

Redtop: July 2, 12, 13, 20-22 and 25. The highest count was four grains on July 12.

Timothy: July 8-15, 18, 19 and 22. The highest count was six on July 8.

Orchard Grass: Two grains were seen on each of the following days: July 8, 11-13.

According to the assembled data there were only two days during the grass hayfever season in which grass pollens occurred in sufficient quantities to induce hayfever.

Ragweed:

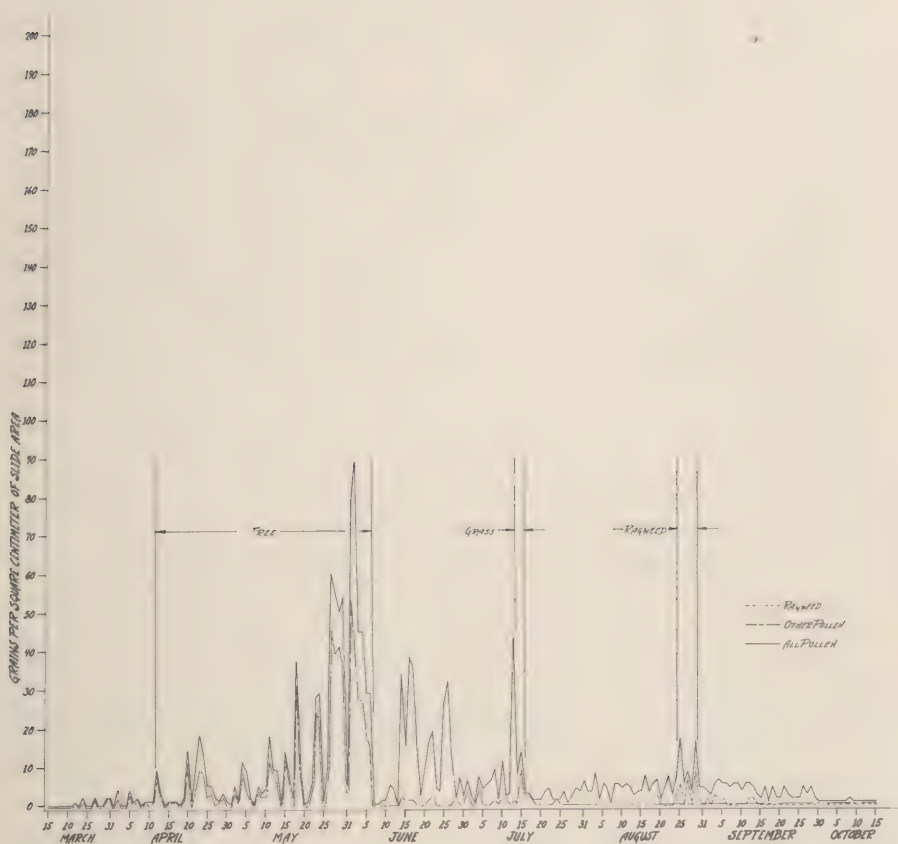
Short Ragweed: August 17-19, 25-29; September 2, 4, 10, 11, 13 and 14. The highest count was twelve on August 28.

There were only four days during the season in which Ragweed pollen occurred in sufficient quantities to effect hayfever.

STATION NO. 19 was located in the Township of Ossipee at an altitude of about 650 feet. The station was maintained by personnel of the New Hampshire Fish and Game Department at a fish rearing station located there.

The station was situated in a glacial outwash plain somewhat similar to the Town of North Conway. Most of the land is sand and gravel wasteland, with Pitch Pine, Scrub Oak and Poplar the predominating timber. The terrain ranges from rolling to flat, there being no particular heights anywhere near the station. There were no obstructions in any direction to interfere with the operation of the pollen collecting device.

The following graph indicates the appearance of the various pollens during the season:



Ragweed growths on main highways were classified as moderate to heavy by the reconnaissance survey. There was little Ragweed around the hatchery area nor were there any farms near enough to influence the pollen count.

An examination of the graph and records indicates the following pollen grain occurrence:

Tree:

Willow: March 22 and 27, the greatest number being two on March 27.

Poplar: March 24, 30, 31; April 2, 5-7, 9, 11-13, 16, 19, 20, 22-24, 26, 29; May 2 and 4. The greatest number occurred April 20 and 23, when five were seen.

White Ash: April 2, 15; June 1 and 2. The greatest number was recorded June 2, when two were seen.

Elm: April 12, 13, 20, 22, 23 and 25, the highest count being two on April 23 and 25.

Maple: April 19, 20, 23, 24; May 11, 12, 23, 24, 27-30; June 1-3, 5, 6, 14 and 22. The greatest number was recorded June 1, when twenty were counted.

Birch: April 16, 23, 24, 28, 29; May 3-6, 8-13, 15, 16, 18, 19, 22-24, 26-31; June 1-3, 5, 6, 16, 17, 20, 21 and 27. The greatest number occurred May 27, when forty-one were seen.

Oak: May 24, 27, 28, 29; June 3, 14 and 15. The greatest number occurred June 3, when six were recorded.

Beech: May 15, 26, 28, 29, 30; June 1-3, 5 and 6. The greatest number occurred June 6, when five were recorded.

Tree pollens were present in sufficient quantities to induce hayfever as follows: Maple, 4 days; Poplar, 1 day; Birch, 21 days; and Oak, 1 day.

Grasses:

June Grass: July 1 and 4, the highest count being July 1, when two were seen.

Redtop: July 1 and 4, the highest count being July 4, when two were recorded.

Canada Bluegrass: One grain was recorded July 4.

Timothy: July 8, 10, 11, 13, 15, 16, 18 and 24, the highest count being on July 15, when seven were recorded.

Orchard Grass: July 10 and 15. The highest count was two on July 15.

During the grass pollinating season there was but one day in this area when the grass pollens occurred in sufficient densities to induce hayfever.

Ragweed:

Short Ragweed: August 19, 24, 25, 27, 29, 30; September 1, 3-5, 12 and 13. The greatest number occurred August 29, when eight were seen.

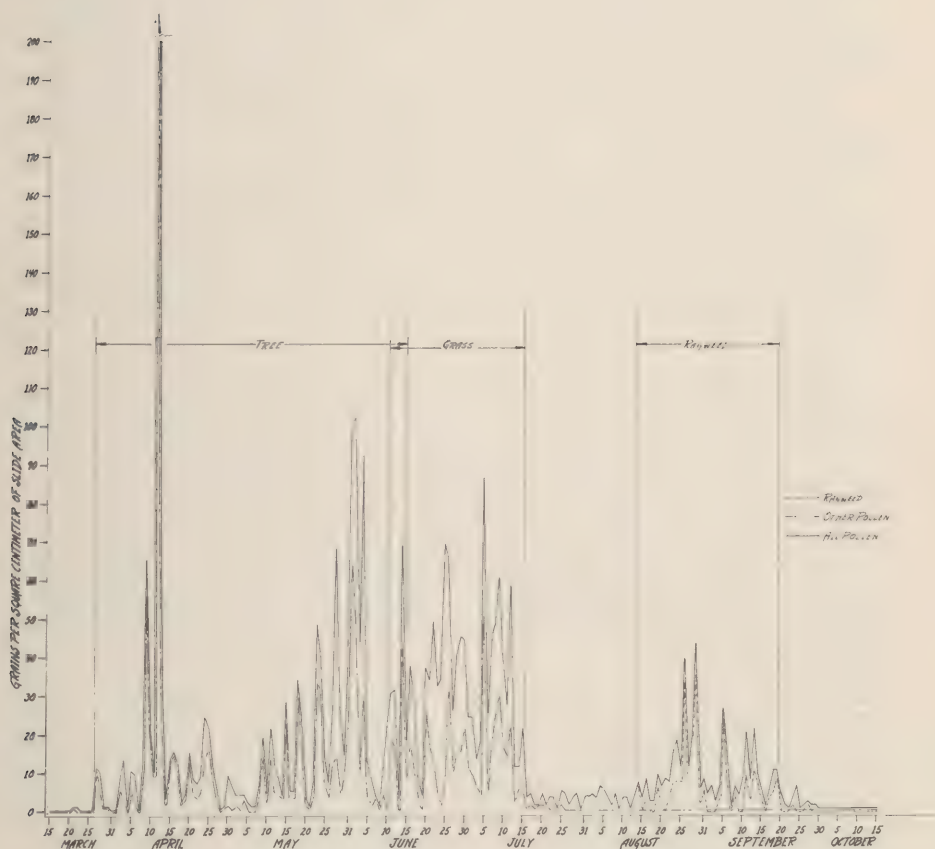
Short Ragweed appeared on only two days in sufficient density

to induce Ragweed hayfever.

The area in and around this station appears to be relatively free of airborne hayfever pollens.

STATION NO. 20 was located in the City of Rochester at an altitude of about 250 feet. This station was maintained throughout the season by Mr. C. Goodwin, the local health officer, at his home.

The following graph indicates the occurrence of the various pollens during the season:



Rochester is located in the coastal plain along the southeastern part of New Hampshire, about four miles from the Maine border. This plain is a continuation of the one in which Stations No. 4 and No. 19 are located. This is the remains of an old pene plain which is gradually being eroded to the sea. The area is heavily industrialized and farmed. Surrounding timber types are White Pine, Pitch Pine, Birch and the various mixed hardwoods. The growing season would be similar to that of Concord.

The collecting device had a northwestern exposure. There was slight wind interference to the northwest from a small barn, the rest of the azimuth being unbroken.

A reconnaissance survey for the occurrence of Ragweed plants in the area indicated heavy growths along main highways, throughout the city, and around farms and small gardens.

An examination of the graph and records indicates the following pollen grain appearance:

Tree:

Poplar: March 21, 27, 28; April 3, 5, 9, 12, 13, 15, 16, 20, 21, 23-27; and May 25. The greatest number recorded was eleven on March 27.

Birch: March 28-30; April 29; May 2, 4, 8-16, 18-20, 22-31; June 1, 2, 4-7, 14, 15, 20 and 22. The greatest number occurring was twenty-nine on May 18.

Maple: April 2, 3, 6, 13, 15, 16, 18-22, 24, 26; May 9, 12, 23, 27-31; June 1, 2 and 4. The greatest number occurring was twelve on June 1.

Elm: April 5, 6, 8-26 and 30. The greatest number was recorded April 12, when 216 were seen.

Oak: May 23, 26, 27, 31; June 1-5, 7 and 9. The greatest number occurred June 1, when twenty-two were recorded.

Beech: May 11, 23, 26; June 1-5. The greatest number occurred June 2 to 4, when five grains were seen each day.

White Ash: May 13, 19, 24, 27 and 30. The greatest number was recorded May 24, when ten were seen.

The tree pollens appeared during the season in quantities sufficient to induce hayfever as follows: Elm, 11 days; Maple, 2 days; Poplar, 2 days; Birch, 17 days; Oak, 3 days; and White Ash, 1 day.

Grasses:

June Grass: June 11, 12, 14-18, 20-23 and 25-28. The greatest number recorded was fourteen on June 20.

Canada Bluegrass: June 11, 12, 14, 16, 17, 20-22, 25, 26, 28 and 29. The greatest number occurring was ten on June 11.

Redtop: June 11, 12, 14-17, 20, 22, 25-27; July 5-12, 14, 15, 17 and 19-21. The greatest number was recorded on July 5, when forty-four were seen.

Sweet Vernalgrass: June 14-18, 20-26, 28-30; and July 3. The greatest number occurred June 26, when fourteen were recorded.

Orchard Grass: June 15, 26, 28, 30; July 1-5, 7-12 and 14. The highest count was July 9, when eleven were seen.

Timothy: June 16, 20, 22, 26-30; July 1-14 and 25. The highest count was June 30, when seventeen were seen.

The following grass pollens occurred in sufficient densities to effect hayfever: Sweet Vernalgrass, 2 days; June Grass, 7 days; Orchard Grass, 3 days; Timothy, 6 days; and Redtop, 7 days.

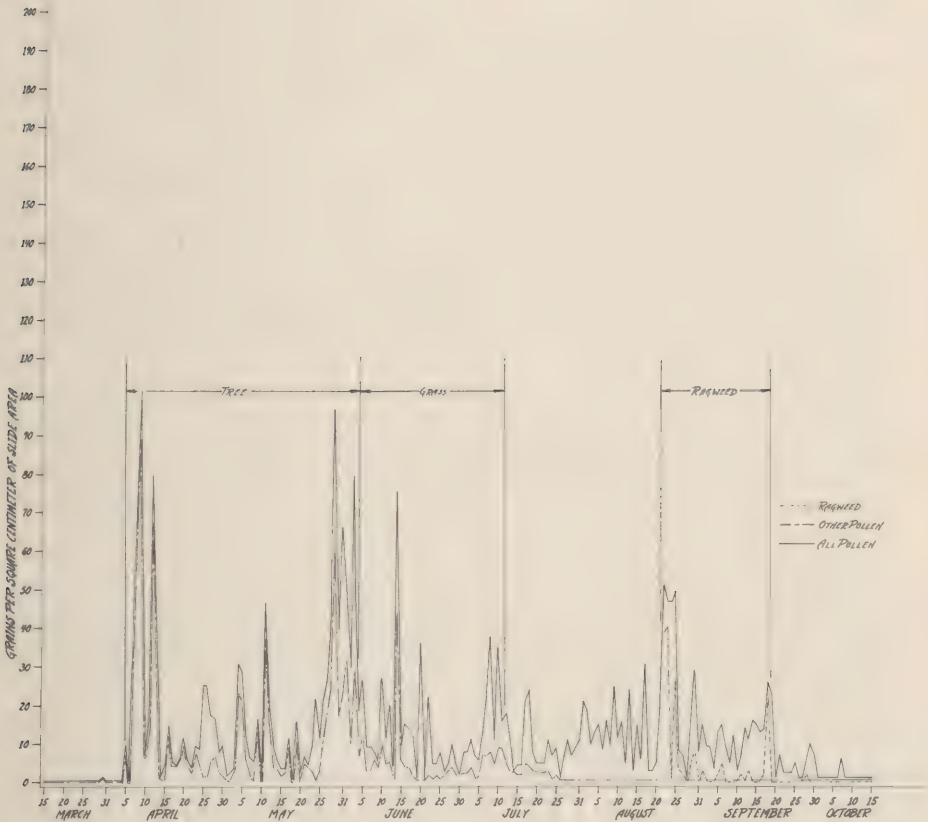
Ragweed:

Short Ragweed: August 14, 16, 19, 20, 22-31; September 4-6, 8, 11-15, 17-19, 23 and 27. The greatest number was recorded August 29, when thirty-five were seen.

Short Ragweed pollen occurred on fifteen days in sufficient densities to cause allergic individuals to exhibit the symptoms of hayfever.

STATION NO. 21 was located in Charlestown at an altitude of about 400 feet. This station was maintained throughout the season by Mr. L. L. Comstock, the local health officer.

The following graph indicates the occurrence and density of the various hayfever pollens:



Charlestown is in the southern reaches of the Connecticut River Valley, less than a mile from the river. This valley is heavily farmed along the intervalles, as well as several miles back from the river in the hills. The predominating timber type is White Pine, with an admixture of the various hardwoods. Terrain ranges from flat to rolling, with some rock outcrops having mica and feldspar mines.

The device had a southern exposure, and was slightly blocked at the north by a small barn.

The reconnaissance survey indicated heavy growths of Ragweed along the main highways, around truck garden patches, and in waste areas around various homes in the town.

Examination of the graph and records from this station reveals the following occurrences of pollen grains:

Tree:

Poplar: April 5, 8, 9, 16, 25, 27 and 29. The highest count occurred April 5, 8 and 9, when three grains were recorded.

Elm: April 5, 7-13, 16-23 and 28, the greatest number occurring April 8, when sixty-one were recorded.

Maple: April 12, 14, 20, 23, 24; May 4, 9, 11, 12, 16, 22, 23, 25-30; June 1 and 3. The highest count was seventeen on May 29.

White Ash: April 21 and 24; May 4, 27 and 29. The highest count was recorded April 24, when three grains were seen.

Birch: April 25, 27-30; May 3-9, 11-15, 17, 19, 21, 25, 27-31; and June 1-6. The greatest number occurred May 11, when thirty-four were recorded.

Oak: May 21, 26, 29-31; June 1-5 and 8. The highest count appeared May 29, when twenty-five were seen.

Beech: May 28-31; June 1, 3 and 4. The highest count occurred June 1, when eleven were recorded.

Tree pollens occurred on the following number of days in sufficient quantities to induce hayfever in susceptible individuals: Elm, 10 days; Maple, 5 days; Birch, 14 days; Oak, 5 days; and Beech, 2 days.

Grasses:

June Grass: June 4-6, 8-12, 14, 16-18 and 26. The highest count occurred June 14, when seventeen were recorded.

Redtop: June 5, 11, 14, 24, 27; July 3, 6-8, 10-12, 14, 15, 17-20. The highest count occurred July 8 and 11, when four were seen.

Canada Bluegrass: June 6 and 11. One grain appeared on each of these days.

Timothy: June 9, 10, 12, 14, 15, 17, 22, 28-30; July 1, 3, 6-13, 15, 17, 19, 23 and 24. The greatest number occurred June 14, when twenty were seen.

Sweet Vernalgrass: June 5, 6, 10, 14; and July 1. The greatest number recorded was four on June 5, 10 and 14.

Orchard Grass: June 12, 17; July 1, 5, 7-12 and 20. The greatest number was recorded July 7 and 10, when three were seen.

Grass pollens occurred in sufficient numbers to induce hay-

fever as follows: June Grass, 1 day; and Timothy, 1 day.

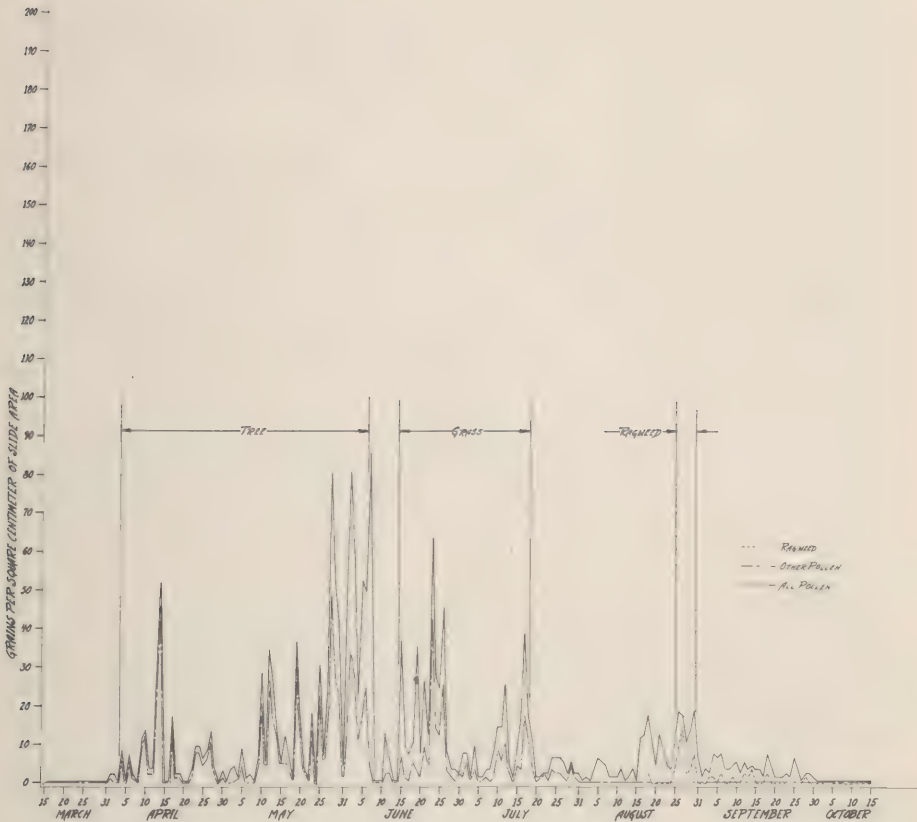
Ragweed:

Short Ragweed: August 22, 23, 25, 27, 29, 30; September 1, 5, 6, 11, 13, 17, 18 and 28. The greatest number occurred August 23, when forty were seen.

Short Ragweed occurred on five days in sufficient quantities to induce hayfever.

STATION NO. 22 was located on the Caroline Fox Experimental Forest in Hillsborough, at an altitude of about 700 feet. Mr. Henry Baldwin of the New Hampshire Forestry and Recreation Department, Director of the Experimental Forest, maintained this station throughout the season.

The following graph indicates the occurrence and density of the various hayfever pollens:



The collecting device was open to wind movement on all sides.

Hillsborough is in the southwestern part of New Hampshire and is situated in a region of rolling hills and shallow valleys of the Contoocook River. The predominating timber type is White Pine, with an admixture of the various hardwood types. The farms are situated principally in the valleys, with some dairy farming in the hills. The town is heavily industrialized.

The area immediately surrounding the collecting device was comparatively free of Common Ragweed, due to the fact that this station was maintained on the Experimental Forest. The main highways, homes, waste areas and truck patches were rated as heavily infested with Ragweed by the reconnaissance survey of the general region.

An examination of the graph and records from this station reveals the following occurrence of pollen grains:

Tree:

Willow: April 1 and 17. The highest count was April 17, when six were recorded.

Elm: April 4, 6, 9-11, 13, 14, 17, 22, 23, 25 and 26. The greatest number occurred on April 13, when thirteen were seen.

Poplar: April 6, 7, 9, 10, 13, 14, 18, 19, 23, 25, 30; and May 18. The greatest number occurred April 13, when twelve were seen.

Maple: April 11, 14, 17, 23, 26-28; May 12, 21, 22, 25, 26, 28-30; June 1-6 and 16. The highest count was made April 14, when forty-three were seen.

Birch: April 13; May 4, 5, 9-17, 19-21, 23, 25-31; June 1-7, 12, 19 and 23. The greatest number was recorded May 19, when thirty-four were seen.

Oak: May 25, 27-30; June 1-4 and 7. The highest count occurred May 28, when seventeen were seen.

White Ash: May 25-27, 29, 30; and June 5. There was only one grain seen on each of these days.

Beech: May 27, 28, 30; June 1, 2, 5 and 11. The greatest number occurred May 30, June 5 and 11, when two were seen.

Tree pollens occurred in sufficient numbers to induce hay-fever on the following number of days: Elm, 4 days; Maple, 9 days; Willow, 1 day; Poplar, 1 day; Birch, 16 days; and Oak, 4 days.

Grasses:

June Grass: June 7, 12, 13, 18, 19, 21-28 and 30. The highest count occurred June 23, when eight were seen.

Canada Bluegrass: June 7, 18, 20, 23; July 2 and 4. The highest count occurred July 2, when three were seen.

Sweet Vernalgrass: June 15, 18, 21, 23-27; July 1 and 4. The highest count occurred June 26, when eight were seen.

Orchard Grass: June 13, 21, 23, 25, 26; July 10-12, 15, 17, 18 and 21. The highest count occurred July 12, when nine were seen.

Redtop: June 15, 19, 22-26; July 3, 4, 13, 16-19, 22, 24-29. The highest count occurred July 17, when sixteen were seen.

The station was located at the eastern edge of the city beside a golf course, on a hill overlooking the wide valley. There was a slight interference to wind movement by a building at the east, the device being otherwise unobstructed.

Manchester is situated in the Merrimack River Valley, and is heavily industrialized. This city has the greatest population of any in the State. The area immediately surrounding Manchester is also heavily farmed, particularly in the alluvial intervals of the Merrimack Valley. Timber types are the predominating White Pine, with an admixture of hardwood. The terrain is from flat to rolling, and the soil sandy to sandy gravel.

Dense growths of Ragweed were found throughout the city, along all highways leading into the city, in waste areas, vacant lots, parking lots, and in and around many small gardens and farms.

An examination of the graph and records of this station indicates the following occurrence of hayfever pollens:

Tree:

Poplar: March 27, 29, 31; April 2, 3, 5-10, 20, 22 and 24-27. The highest counts occurred April 9 and 22, when ten were seen. Willow occurred once, April 2, when one was seen.

Birch: April 3, 4, 6, 30; May 3-5, 8-16, 18-24, 27-31; June 1-6, 13, 14 and 22. The highest count occurred May 12, when thirty-nine were recorded.

Elm: April 5-13, 16, 21, 22, 24, 26; and May 2. The greatest number was recorded April 12, when twenty-five were seen.

Maple: April 4, 5, 15, 16, 19-26; May 9, 11, 17, 19, 23, 24, 27, 29, 31; and June 1-3. The highest count was recorded April 19, when fifty-five were seen.

Oak: May 11, 24, 27-29 and 31; June 1-4 and 22. The highest count was recorded May 28, when sixty-six were seen.

White Ash: May 11, 12, 15, 18, 24; and June 2. The highest count was May 11, when seven were seen.

Beech: May 12, 24, 30; June 5, 6 and 24. The highest count was recorded June 6, when two were seen.

Tree pollens occurred on the following number of days in sufficient densities to induce hayfever: Elm, 6 days; Maple, 4 days; Poplar, 2 days; Birch, 16 days; Oak, 7 days; White Ash, 1 day.

Grasses:

June Grass: June 9, 11, 14-16, 18, 20-23. The highest count occurred June 22, when seven were seen.

Orchard Grass: June 11, 18, 29, 30; July 1, 3-5 and 8-10. The highest count occurred June 29, when two were seen.

Timothy: June 14, 16, 29, 30; July 1-5, 7-10, 12-16 and 18. The highest count occurred June 29 and July 8, when five were seen.

Redtop: June 14, 21 and 22. One grain was seen on each of these days.

Canada Bluegrass: June 20-22, and 29. One grain was seen on each of these days.

June Grass was the only grass pollen occurring in sufficient quantity to cause hayfever, and that on only one day.

Short Ragweed: August 12, 16, 18-31; September 1-6, 9-15, 17, 18, 20, 21 and 28. The greatest number was seen August 27, when twenty-eight were recorded.

STATION NO. 24 was located in Rye, at an altitude of five feet. This station was maintained by Mr. Ben Saunders of Rye Beach. The device was situated 50 feet from the ocean and was exposed to the air movement on all sides.

GRASSES PER SQUARE CENTIMETER OF SLIDE AREA

Y-axis scale: 0, 10, 20, 30, 40, 50, 60, 70, 80, 90, 100, 110, 120, 130, 140, 150, 160, 170, 180, 190, 200, 210, 220, 230, 240.

X-axis labels: MARCH, APRIL, MAY, JUNE, JULY, AUGUST, SEPTEMBER, OCTOBER.

Legend:

- RAINED
- OTHER POLLEN
- ALL POLLEN

Annotations on graph:

- TREE (March 10 to June 5)
- GRASS (June 10 to July 15)
- RAINED (August 10 to September 10)

The surrounding terrain is flat. White Pine timber predominates, with an admixture of hardwoods. This was in the heart of the seacoast region, an area of great recreational value. Highway usage is one of the highest in the State. A recreational development is about 500 feet away where tourists will camp in large numbers.

The area immediately adjacent to the location of this device was listed as having a light growth of Ragweed. The surrounding area had heavy Ragweed infestations, particularly along the main highways and along the shingle of the shore. Some areas extended for several hundred feet in which there were nothing but solid dense growths of undisturbed Ragweed plants. Ragweed reached its optimum development in the State along the seashore.

Examination of the graph and records from this station reveals the following pollen grain occurrence:

Tree:

Poplar: March 15, 30; April 5, 7, 8, 12, 13, 15, 16, 20-26 and 28. The highest count appeared April 21, when seven were seen.

Elm: April 5, 7-10, 12, 13, 15, 19, 21, 24 and 25. The greatest number was seen April 12, when fifty-one were recorded.

Maple: April 8, 12, 13, 15-17, 19-22, 24; May 22, 23, 27; June 1, 3, 5 and 6. The greatest number appeared April 12, when twelve were seen.

Birch: May 7, 9, 10, 19, 22, 26, 27, 29, 31; June 1, 3-6, 9, 14, 16 and 22. The greatest number was recorded June 1, when thirty-eight were seen.

Oak: May 10, 27, 29, 31; June 1, 3-5. The greatest number was recorded May 29, when twenty-seven were seen.

Beech: May 29; June 1 and 3. The greatest number was recorded June 1, when three were seen.

White Ash: There was one grain recorded on June 4.

Tree pollens occurred on the following number of days in sufficient numbers to induce hayfever: Elm, 5 days; Maple, 4 days; Poplar, 3 days; Birch, 5 days; and Oak, 1 day.

Grasses:

June Grass: June 6, 15-18, 20, 24 and 25. The highest count occurred on June 18, when thirteen were seen.

Sweet Vernalgrass: June 15, 17, 18, 20, 21, 25 and 30. The greatest number was recorded June 20, when ten were seen.

Canada Bluegrass: June 15-18, 20 and 21. The greatest number was recorded June 17, when six were seen.

Timothy: June 15-18, 20, 22, 24, 25, 27, 30; July 1-4, 7-11 and 14-17. The greatest number occurred June 30, when nineteen were seen.

Redtop: June 15-18, 20, 25; July 7-13 and 15-22. The greatest number occurred July 10, when ten were seen.

Orchard Grass: June 16, 23, 24, 30; July 1, 3, 7-13 and 16. The greatest number occurred July 10, when fourteen were seen.

Grass pollens occurred on the following number of days in

sufficient density to induce hayfever: Sweet Vernalgrass, 2 days; June Grass, 5 days; Orchard Grass, 2 days; Canada Bluegrass, 1 day; Timothy, 4 days; and Redtop, 2 days.

Ragweed:

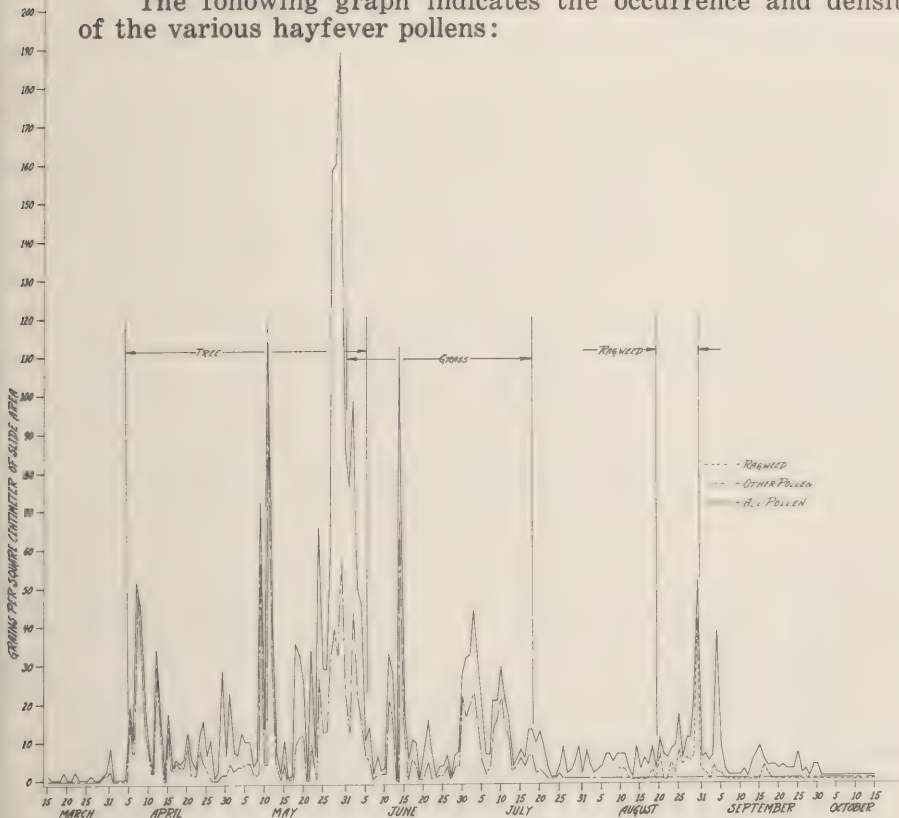
Short Ragweed: August 20, 24-30; September 1-6, 10 and 24. The greatest number was recorded on September 10, when thirty-three were seen.

There were ten days during the Short Ragweed season in which there were a sufficient number of airborne pollen grains to induce hayfever.

It is interesting to note that this station, although located on the seacoast where shore breezes are supposed to be clear of the various hayfever pollens, picked up as many grains of pollen during the Ragweed hayfever season as any other comparable station. This is undoubtedly due to the fact that the heaviest growths of Ragweed to be seen anywhere in the State exist up and down the beaches and waste areas of the seacoast region. This condition could be inexpensively and easily corrected through the use of a chemical spray control method.

STATION NO. 25 was located in Hinsdale, at an altitude of about 400 feet. This station was maintained by Mr. R. C. Hildreth, the local health officer.

The following graph indicates the occurrence and density of the various hayfever pollens:



The device had a southern exposure. There was some interference to wind movement on the north by a hill and a small building, otherwise there was little blockage.

Hinsdale is in the extreme southwestern corner of New Hampshire, in the Ashuelot River Valley about one-half mile from the Connecticut River Valley. Farming is heavy up and down the Connecticut Valley and along the Ashuelot River Valley. The towns are heavily industrialized. The terrain is rolling to rough. The prevailing timber type is White Pine, with occasional stands of Beech, Birch, Maple and other hardwoods.

The reconnaissance survey for Ragweed growths indicated moderate to heavy infestations on all highways leading into Hinsdale. Ragweed also occurred in Hinsdale along the edges of streets, small vegetable gardens, and in waste areas around the mills located there.

Examination of the graph and records from this station reveals the following pollen grain occurrences:

Tree:

Willow: March 30; and April 20. The greatest number was recorded April 20, when three were seen.

Poplar: March 31; April 5, 7-10, 12, 13, 22-24; and May 11. The greatest number was recorded April 12, when eight were seen.

Maple: March 31; April 11, 15, 17-20, 24, 25; May 11, 18, 24, 25 and 27-31. The greatest number occurring was twelve on May 27.

Elm: April 5-17, 19-21 and 23. The greatest number occurred April 7, when seven grains were recorded.

Birch: April 29, 30; May 1-5, 7-13, 15, 18-20, 24, 25, 27-31; June 1-6, 9 and 21. The highest count was made on May 11, when eighty-one were recorded.

Oak: May 9, 11, 18, 20, 22, 24, 25, 27-31; June 1-4 and 17. The greatest number occurred May 30, when thirty-nine were seen.

White Ash: May 11, 12, 24; and June 3. The greatest number occurred May 11, when twelve were recorded.

Beech: May 12, 13, 18-20, 22, 27-30; and June 3. The greatest number was recorded May 12, 18, 19 and 30, when four were seen.

Tree pollens occurred on the following number of days in sufficient numbers to effect hayfever: Elm, 8 days; Maple, 4 days; Poplar, 2 days; Birch, 9 days; Oak, 11 days; and White Ash, 1 day.

Grasses:

Sweet Vernalgrass: June 4, 11, 12, 14, 15, 17, 18, 21, 26 and 28-30. The greatest number occurred June 14, when twenty were seen.

June Grass: June 2-6, 8, 11, 12, 14, 17 and 30. The greatest number occurred June 2, when eleven were seen.

Canada Bluegrass: June 2, 11, 12, 14, 15 and 17. The greatest number occurred June 11 and 14, when three were seen.

Redtop: June 2, 4, 10-12, 14, 18, 21, 30; July 7, 8, 10, 12-17,

19 and 21. The greatest number occurred June 14, when fifteen were seen.

Orchard Grass: June 6, 12, 14, 24, 26, 29; July 1-5, 6-12, 15, 17, and 20. The greatest number occurred July 3, when twenty were seen.

Timothy: June 11, 12, 14, 15, 17, 21, 28, 30; July 1-12, 14-17, 20 and 25. The greatest number occurred July 10, when seventeen were seen.

Grass pollens occurred on the following number of days in quantities sufficient to induce hayfever: Sweet Vernalgrass, 2 days; June Grass, 4 days; Orchard Grass, 6 days; Timothy, 7 days; and Redtop, 1 day.

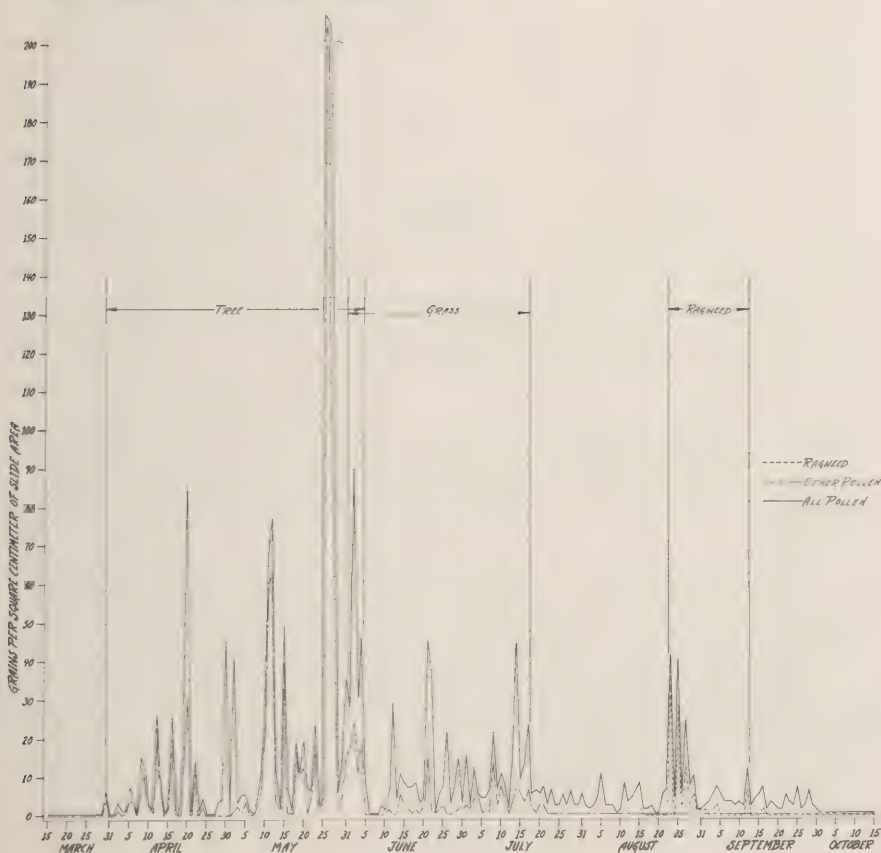
Ragweed:

Short Ragweed: August 9-11, 18, 20, 23-31; September 1, 3-5, 16 and 17. The greatest number occurred August 30, when forty-one were recorded.

Short Ragweed occurred on four days during the season in sufficient numbers to induce hayfever.

STATION NO. 26 was maintained in New Ipswich, at an altitude of about 1,000 feet. The device was maintained during the season by Dr. C. G. Cayward, the local health officer.

The following graph indicates the occurrence and density of the various hayfever pollens:



New Ipswich is on the south central border of New Hampshire, in an area of rolling hills. Very little farming is going on around the township proper, although some is practiced in the immediate vicinity of the station location and in the river valleys around the various sides. The predominating timber types are White Pine mixed with Beech-Birch-Maple, and the various hardwoods. Most of the surrounding country is heavily timbered, this village being on a ridge of hills which runs roughly north and south through the west central section of New Hampshire.

Examination of the surrounding area for growths of Short Ragweed indicated light to medium growths in the town and within a mile or two of the station, increasing to extremely heavy growths down in the valleys and along the main travelled roads.

An examination of the graph and the records for this station reveals that the hayfever pollens occurred on the following dates:

Tree:

Poplar: March 30; April 2, 5-9, 12, 16, 19-22 and 24. The greatest number occurred April 5, when five were recorded.

Elm: April 4-6, 7-13, 15-17, 19, 20 and 22. The highest count was April 12, when twenty-two were seen.

White Ash: April 9, 13; May 19, 20, 22, 23 and 25-28. The greatest number occurred May 19, 20 and 23, when two were reported.

Maple: April 13, 16, 19, 20, 24; May 20, 23 and 25-27. The greatest number occurred April 20, when twenty-five were recorded.

Birch: April 22; May 2, 3, 5, 8-15, 18-20, 22, 23, 25-28, 30 31; and June 1-4. The highest count was made May 12, when sixty-three were recorded.

Oak: May 9, 11, 12, 23, 24, 26-31; June 1-4, 14 and 20-22. The greatest number was recorded May 26, when 250 were seen.

Beech: May 11, 18, 20, 23, 27, 28, 31; June 1 and 2. The highest count was made June 1, when seven were seen.

Tree pollens occurred the following number of days in numbers sufficient to induce hayfever: Elm, 4 days; Maple, 4 days; Birch, 12 days; Oak, 6 days; Beech, 1 day.

Grasses:

June Grass: June 2, 3, 14, 15, 21 and 30. The greatest number occurred June 3, when five were recorded.

Redtop: June 3, 11, 14, 20, 21, 25; July 8, 10, 11, 13-18, 20 and 21. The greatest number was reported July 8, when seven were seen.

Sweet Vernalgrass: June 4, 14, 18, 21, 24, 25 and 29. The highest count was recorded June 4, when six were seen.

Orchard Grass: June 4, 15, 16, 21; July 4, 8, 10 and 13. The highest count was made June 21, when five were seen.

Canada Bluegrass: One grain was recorded on June 21.

Timothy: July 1-4, 6, 8-11, 14-16. The greatest number was recorded July 8, when five were seen.

Grass pollens appeared on the following number of days in sufficient numbers to effect hayfever: Sweet Vernalgrass, 1 day;

and Redtop, 2 days.

Ragweed:

Short Ragweed: August 15, 23, 25-31; September 1, 3, 4, 12 and 16. The greatest number occurring was thirty-seven on August 23.

Short Ragweed occurred on four days during the season in sufficient quantities to induce hayfever.

Summary of Results From Sampling Stations:

A comparison of the graphs for all stations, together with the data, indicates the following average seasonal occurrences, together with the variation from the average.

The three hayfever periods, as they have occurred at each station, have been indicated on the graphs. Lines were drawn where the count per square centimeter of slide area exceeded five grains of hayfever pollen. Data for individual stations can be read from the graphs as they are recorded in this publication, and the write-ups of each station pollen occurrence. Appearances of the individual species and genera, excepting for Ragweed, have been left to the individual station write-up.

Spring or Tree Hayfever Season:

From the average of all stations, the season started April 8 and was over June 7. The earliest occurrence was March 26, at Station No. 20, Rochester. The latest occurrence was June 22, at Station No. 16, Bath. The average length of this season was thirty days. The shortest was twenty days and occurred at Station No. 1, Colebrook. The longest occurred at Station No. 20, Rochester, where a total of eighty-one days was recorded.

There was an average of sixteen days between the tree hayfever season and the grass hayfever season. At Station No. 21, Charlestown, the grass season and the tree season met on June 4; at Station No. 20, Rochester, the tree season overlapped the grass season by four days; at Station No. 26, New Ipswich, the tree season continued into the grass season five days; and at Station No. 25, Hinsdale, the tree season overlapped the grass season by six days. The greatest number of days between the tree and the grass season occurred at Stations No. 4, Conway, and No. 19, Ossipee, where there was a total of thirty-eight days freedom from hayfever pollens.

Summer or Grass Hayfever Season:

The average start of this season was June 23 and the average end was July 18. The earliest was June 4 at Station No. 21, Charlestown; and the latest finish was July 26 at Station No. 13, Pittsburg. The average length of the season was twenty-six days. The shortest period was at Station No. 19, Ossipee, where it occurred for two days. The longest season was at Station No. 6, Lebanon, where fifty-five days were observed.

The average length of time between the grass hayfever season and the Ragweed hayfever season was forty-five days. The shortest interval occurred at Station No. 6, Lebanon, for eleven days. The longest free period was at Station No. 15, Groveton, for forty-eight days.

Fall or Short Ragweed Hayfever Season:

The average season started August 22, and ended September 8. The average total length was eighteen days. The earliest occurrence was August 5, and the last September 25. The shortest Ragweed season occurred at Stations No. 1, Colebrook; No. 3, Whitefield; No. 14, Errol; No. 15, Groveton; and No. 19, Ossipee; for a period of two days. The longest Ragweed season was recorded at Station No. 11, Exeter, for a total of forty-five days.

The offending pollens occurred at all stations during the three seasons with varying densities sufficient to effect hayfever. The variation in length of season is indicated in the foregoing paragraphs. The variations in intensities may be read from the accompanying graphs.

No attempt was made to identify pollens, other than those designated, during the survey. Unidentified pollens were recorded as unknown, no attempt being made to identify them by species or genera, owing to the time necessary for identification.

Records were made of all pollens seen, both known and unknown. The graphs indicate the incidence of all pollens to be the highest during the tree flowering period. The pollens, other than those listed as being hayfever inducing, consisted primarily of Pine, Spruce and Fir during the tree season.

There was a period of pollen-free air between June 7 and June 23, July 18 and August 22.

The data obtained from this study indicate that the tree and grass hayfever situation in New Hampshire, at least in the localities studied, is not one to cause major concern. These pollens do not seem to be airborne in large numbers or density, unless artificially disturbed.

Analysis of these data supports the zonal map listed on Page 15 of the 1947 survey. This map divides the State roughly into three zones: Zone No. 1 includes the area north of the White Mountains; Zone No. 2 the White Mountains and Lakes Region proper; Zone No. 3 the section of the State south of the Lakes, in the heavily industrialized and agricultural region. Correlation of these zones with the Ragweed growth indicates that the zones may be generally typified as follows:

Zone No. 1—Ragweed growths negative to light, with the exception of Berlin; Zone No. 2—Ragweed growths from light to medium; Zone No. 3—Ragweed growths medium to heavy.

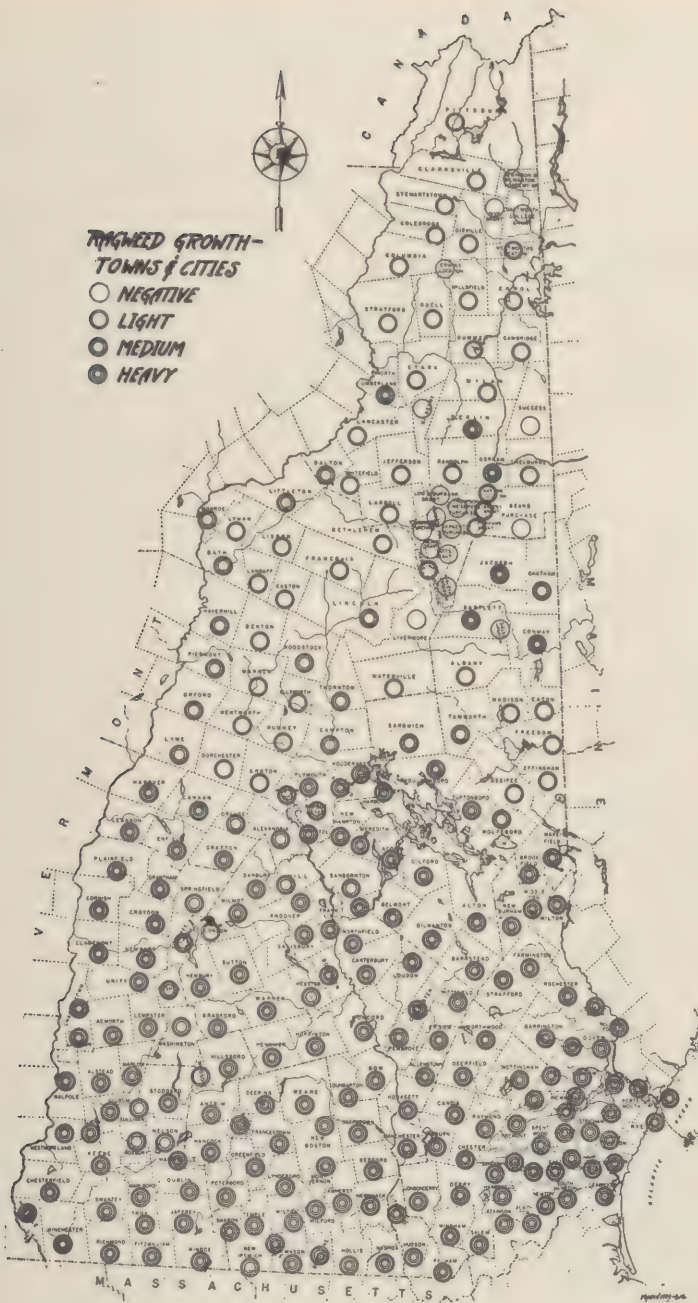


Figure Two.

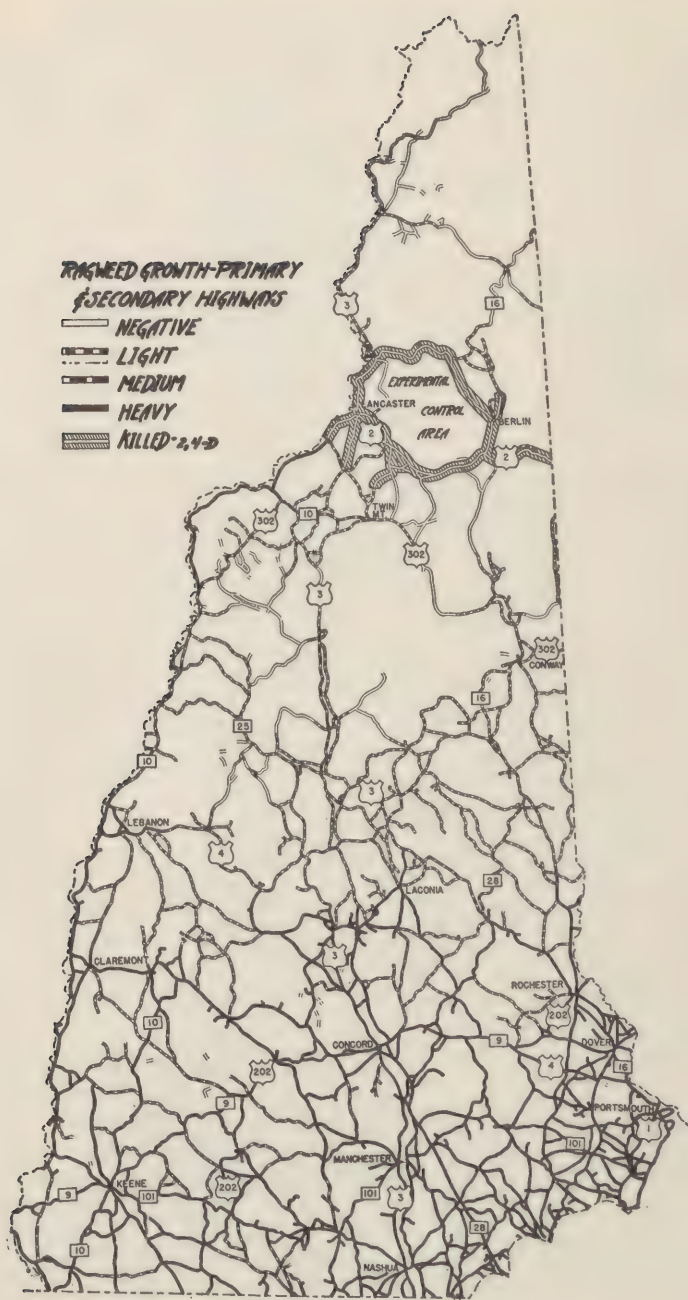


Figure Three.

Ragweed occurs in Zones 1 and 2 principally along the main highways and around private homes, factories and other waste areas. These zones could be economically controlled by the use of chemical sprays. There are many areas within these two zones which could be classified as Ragweed-free with the expenditure of a small amount of effort and funds.

All pollens appeared in greater numbers and for a greater number of days during the 1948 survey than they did during the 1947 survey. This was due to growing conditions and weather, which also were particularly favorable for Short Ragweed. The first part of the season was much wetter than normal and the latter part considerably drier than normal, conditions which are conducive to Ragweed growth and pollination. Generally, the incidence and occurrence of hayfever pollens were found to be in the same ratio for the 1948 season as the 1947 season, except at Station No. 6, Lebanon.

Reconnaissance Surveys:

Supplementing the actual airborne pollen density measurements, a reconnaissance survey for Ragweed growth was made of the entire State. The purpose of this reconnaissance survey was to determine the actual stand of Ragweed in the various areas. Observations were made of growth along the highways, in vacant lots, cultivated fields, and various waste areas in the cities and towns. The density and extent of growth was estimated and classified into four categories: Negative, Light, Medium and Heavy. No attempt was made at actual measurement of the density of growth, results being based entirely on visual estimates of the observer.

The density growth categories were arbitrarily established according to maximum growth as found in New Hampshire and will not, of course, parallel results of other studies in states where hayfever plant growth is more extensive.

No instances were found where areas of Ragweed exceeded more than one-tenth of an acre. The areas classified as heavy consisted essentially of a one to two-foot width of Ragweed growth in the burm, running continuously along the highways and along town or city streets. Growths were also evaluated as found in cultivated areas, such as corn fields, bean patches, in vacant lots, near telephone poles, driveways, commercial buildings, filling stations and residences. Ragweed attained its heaviest growth in the center of the largest cities and towns. Many resorts and hotels in an otherwise Ragweed-free area had Ragweed growing immediately beside the buildings and throughout the entire service area at the rear of the establishment. It was noted in many areas that Ragweed grew along the edges of main highways in strips averaging one to two feet in width. However, when the sides of the highway were shaded by trees or heavy growths of grasses, shrubs and ferns, no Ragweed was seen.



Short Ragweed Growth Along Side the Highways.

Short Ragweed Growth at the Seashore.



Reference is made to the map, Figure 2, indicating Ragweed growths as they were classified by the observer. The map with concentric circles indicates Ragweed growth as it was recorded within the community. It should be noted that while a community may be surrounded by forest, or some other completely Ragweed-free area, the populated areas may have a heavy growth of Ragweed. The map shows that in communities with large populations the growth of Ragweed is also heavy. This is due largely to the fact that Ragweed is a civilized plant and advances or recedes with so-called civilization unless eradication measures are inaugurated.

The map shown in Figure 3 shows the primary and secondary highway system in New Hampshire. The total mileage is 3,664 miles. A study of the map reveals that the zonal plan for Ragweed growth as postulated in our previous report is supported by Ragweed growth classifications along highways. Also, there is support for the conclusion given that "where population is the highest, Ragweed is the densest." This map demonstrates particularly that Ragweed is readily accessible and can be controlled easily by the use of chemical sprays.

The only place where Ragweed was found in the extreme north country near the Connecticut Lakes was beside the main highways, around farm homes and in the Town of Pittsburg. The forest highway leading into the Waterville Valley, in the heart of the White Mountains, was completely free of any Ragweed growth for a number of miles, only to have it appear at a recreational development near the end of the highway.

According to some observers in other states, the range and incidence of Ragweed is continuing to increase. The study in New Hampshire has been going for too brief a time to confirm or deny this statement. Ragweed growth was found, however, to have increased its density in New Hampshire in 1948 over that observed in 1947. This was probably due to the better growing season as previously discussed. The 1947 survey indicated the area north of Colebrook, alongside the main highway, to have negative to light growths of Ragweed. The 1947 reconnaissance survey also listed the area around Dixville Notch as having light growths. The 1948 reconnaissance survey indicated the classification in these areas to be medium, and in some cases dense growths were observed where last year there were but a few scattered plants.

From the reconnaissance surveys made by this Department, it is estimated that less than 10 percent of the acreage listed for cities, agriculture, and barren would be that on which Ragweed could occur. Further, it was concluded that less than 2 percent of the entire land area of New Hampshire is a possible habitat for Ragweed.

Control Measures

The data from these studies indicate that the pollen of

Ragweed is the primary cause of seasonal hayfever in New Hampshire. There are several methods by which Ragweed can be controlled. These control measures include the following:

(1) *Pulling*

The simplest and least expensive method of control is pulling up the plants as they appear. This method is slow and can be applied to only relatively small areas where the density of growth is high. This method can be used primarily around residences, vacant lots, small resorts and in the center of cities and towns, where the surrounding area is relatively free of Ragweed. This method is not highly recommended, due to the disturbance of the soil which may provide a ground for an even heavier growth of Ragweed the following season.

(2) *Cutting*

Another method of control is by the use of various cutting instruments such as scythes and mowing machines. This can be used on somewhat larger areas, particularly by farmers and local groups who are interested. In order to carry out this system successfully, several cuttings a year have to be made. The character of Ragweed is such that if the top is not cut off immediately prior to the flowering season the plant will continue to develop flower heads, pollinate, and pollen will be released into the air. Examples of this were noted along some of the highways, where the plant had been cut back during the course of the State Highway weed control program. The plant flowered and pollinated when only three to six inches in height, which is particularly striking when the normal height of this plant is two to three feet.

(3) *Herbicides*

The most efficient and inexpensive control method for use on large areas are herbicides. These may be placed in three major groups:

A. Soil sterilants—These chemicals make the soil toxic to plants. They are used either in sprays or in dry form. Sodium chlorate, sodium arsenate and borax are the principal compounds in this class. Soil sterilants are chiefly used for fire lanes, parking lots, railroad right-of-ways, and other places where vegetation is not wanted.

B. Non-selective contact herbicides—These chemicals destroy top growth of plants when they are wetted with the spray. They do not kill roots or perennials. Contact herbicides are used in places where mowing is impracticable or where vegetation should be kept in check, such as ditch banks, fence rows and the edges of lawns.

C. Selective herbicides—These are chemicals which may be sprayed on an area to destroy the unwanted growth, while not affecting that growth which is desirable.



*Spraying With Back Pack Pumps and 2, 4-D at Littleton
and Bethlehem.*



There are three sub-groups of these selective herbicides: a) Those selective because they do not wet the crop; b) oil sprays that kill most plants; and c) the growth regulator or hormone type. The only one of these three groups which is practical for Ragweed control is the so-called 2, 4-Dichlorophenoxyacetic Acid (commonly known as 2, 4-D). The effect of 2, 4-D is physiological in that the chemical, or its effect, travels through the plant system to induce a teleomorphic response which contributes to the death of the plant. The action is not rapid and death comes on gradually but surely.

The remarkable thing about 2, 4-D is that it effects most broad-leaved plants but usually not the grasses. It may be used as a selective spray for turf to kill Ragweed, Dandelions, Plantain and many other weeds. Care should be used in handling this 2, 4-D so that the chemical will not land on some of the more desirable broad-leaved plants, such as the various horticultural species used in landscaping. This chemical is non-toxic to man or animals.

2- 4-D is produced by a number of manufacturers, and may be purchased in local stores. It is usually applied in a spray, and best results are obtained by using at least 40 percent 2, 4-D in solution.

Control Programs

The Town of Lancaster sprayed all streets and town property with 2, 4-D during 1948 and, in addition, the spray equipment was available for the use of private individuals. Through this control program, classification of Ragweed growth changed from a heavy to a light growth in this community.

The City of Berlin inaugurated a control program with the cooperation of the Boy Scouts. Due to the extensive growths in the city and the relatively late date in getting started, the situation there did not change enough to revise the heavy classification. This probably will be remedied during the coming season.

The New Hampshire State Highway Department, in cooperation with this Department, conducted a program of Ragweed control along certain highways during the 1947 and 1948 seasons. An experimental area was selected for control spraying with 2, 4-D solution. Figure 3 shows the control area. An examination of the roadsides in this area one month after spraying revealed that all Ragweed growth within the highway right-of-way had been destroyed by the chemical spray. Spraying was done with a 150 gallon tank mounted on a stake body truck. An orchard type spray gun was used which necessitated the operator's walking beside the truck to apply the spray. The spray consisted of 40 percent 2, 4-D liquid solution which was an esterone of 2, 4-D with the spreader added by the manufacturers. The cost of spraying was two dollars for each mile of highway, which included both sides of the road. The expense included

labor, chemical and the operating cost of the truck and equipment. Approximately 150 gallons of solution were sprayed per hour. Acre costs were difficult to compute because of the type of spraying done; however, 150 gallons would cover approximately one acre.

One part of the experimental area east of Lancaster required three days for control spraying during the 1947 season. This same area was covered by one day's spraying in 1948. The time reduction was due to a decrease in the density and incidence of Ragweed growth caused from the previous year's control spraying. The same men, equipment and chemical were used in the 1948 season as were used in the 1947 season.

Application of the above costs to the entire State, for spraying all primary and secondary highways, amounting to slightly less than 3,700 miles, would indicate an approximate expenditure of \$7,000 for labor, chemicals and truck mileage. This cost could be reduced if a 500-gallon tank truck and a boom sprayer operated at 200 pounds pressure were used. The tank truck, when not being used for Ragweed control, would be available for other purposes such as forest fire fighting. The spray program should be carried out by beginning at the southern part of the State during the first part of the Ragweed growing season, then moving progressively north. Obviously, the one small truck now available at the State Highway Department could spray only a small percentage of the highways in the State.

Summary

The results of studies of the hayfever situation in New Hampshire, covering a period of two years, are presented in this report.

The studies included evaluation and classification of Ragweed growth and Ragweed pollen density counts for the two seasons in 1947 and 1948, and daily total pollen density counts at 26 sampling stations during the pollinating season of plants, from March 15 to October 15, 1948.

Pollens from trees occurred in greater number and for longer periods than did pollens of grasses and Ragweed.

Pollens from grasses occurred in greater number, and for a longer period in the 1948 season than in 1947. Airborne pollen concentrations varied between stations, influenced largely by the ratio between forest and agricultural land. Birch, Elm and Maple predominated for tree pollens; whereas Timothy, June Grass and Redtop predominated for the pollens of grasses. While a small percentage of the population are effected by pollens of trees and grasses, it is obvious that control of air contamination for these pollens is not feasible. Additional information on pollens from trees and grasses will be found under the discussion of each sampling station.

Authorities estimate that 90 percent of hayfever is due to



Spraying 2, 4-D With Power Equipment at Laconia.



the pollen of Ragweed. Since Giant or Tall Ragweed (*Ambrosia trifida*) was not found in New Hampshire, the following conclusions are made on the basis of Common or Short Ragweed (*Ambrosia elatior*) growth and pollination.

1) A large percentage of the land area of the State is at such an altitude that Ragweed will not grow.

2) Approximately 81 percent of the total land acreage of the State is forest, in which Ragweed does not grow.

3) The surrounding states, and the Province of Quebec, have little effect on the airborne pollen density of the State, with the exception of a small part of Vermont.

4) Reconnaissance surveys made to evaluate Ragweed growths showed that, in most areas, growths were not of sufficient magnitude but that they could be controlled readily. Many localities were found to be practically free or to have very light growths in restricted areas. In other areas, the growth was found to be more extensive, but no Ragweed growths were found which exceeded one-tenth of an acre. It is estimated that Ragweed has a probable habitat of less than two percent of the State's area.

5) Data on airborne Ragweed pollen concentrations were obtained at 12 stations located fifty air miles apart during the 1947 season, and at 26 stations located 25 air miles apart during the 1948 season. These data showed that airborne Ragweed pollen, as collected daily at all stations, was not occurring in quantities sufficient to induce hayfever symptoms at some locations; whereas at other stations the quantities were greater and were present for a longer period of time.

The highest pollen densities and longest seasons occurred generally in the southern section of the State, whereas the lowest densities and shortest seasons were found in the northern part of the State. At 18 of the 26 stations, Ragweed airborne pollen densities occurred in quantities sufficient to induce hayfever on only 5 or less days.

Pollen indices as calculated by O. C. Durham, Technical Director, National Pollen Survey Committee, American Academy of Allergy, are given in Figure 4. It will be noted that the indices for the northern part of this State (Zones No. 1 and No. 2) are very low when compared with figures from other states. The areas at Station No. 2, Berlin, and No. 6, Lebanon, showed higher index figures for Ragweed pollen incidence than their surrounding areas and are not considered typical. Indices in the southern part of the State (Zone No. 3) were higher than Zones No. 1 and No. 2; however, they were lower than most indices from other states.



Before and After Spraying With 2, 4-D.



RAGWEED POLLEN INCIDENCE FOR NEW HAMPSHIRE
ARRANGED ACCORDING TO ZONES OF THE STATE

	Station Number	Location	Index
ZONE NO. 1	1	Colebrook	1.00
	2	Berlin	11.00
	3	Carroll	0.48
	13	Pittsburg	0.61
	14	Errol	0.41
	15	Groveton	2.00
		Average (Including Berlin)	2.58
		Average (Excluding Berlin)	0.90
ZONE NO. 2	4	Conway	4.00
	5	Warren	1.00
	6	Lebanon	17.00
	16	Bath	3.00
	17	Lincoln	3.00
	18	Holderness	4.00
	19	Ossipee	2.00
		Average (Including Lebanon)	4.14
		Average (Excluding Lebanon)	2.83
ZONE NO. 3	7	Laconia	12.00
	8	New London	1.00
	9	Concord	5.00
	10	Keene	7.00
	11	Exeter	26.00
	12	Nashua	20.00
	20	Rochester	19.00
	21	Charlestown	10.00
	22	Hillsborough	4.00
	23	Manchester	10.00
	24	Rye	13.00
	25	Hinsdale	5.00
	26	New Ipswich	6.00
		Average	10.62
		Average for New Hampshire	7.21

Note: Figures were calculated by O. C. Durham, Technical Director, National Pollen Survey Committee, American Academy of Allergy. The indices are based on three measurable factors: the number of days in the season when pollen concentrations reached 25 grains per cubic yard of air, the maximum daily concentration, and the total annual pollen count.

Figure Four.

The data for airborne Ragweed pollens is based upon the amount of pollen in the air at each individual sampling station, and obviously is not applicable to specific local conditions. Where the Ragweed grew beside highways, sidewalks, homes, and tourist and recreational areas, unnatural disturbance of the Ragweed plants by people and machines causes the pollens to be liberated into the air and reach the breathing zone of individuals. Per-

sons who are susceptible to Ragweed pollen will be affected by these conditions even though airborne pollens from outside areas are present in only small amounts. Many resort hotels, cabins, and tourist homes located in areas generally pollen free could afford their guests complete freedom from exposure to Ragweed pollen by establishing Ragweed control in their own backyard.

Recommendations

1. Consideration should be given by the State to granting funds for the control of Ragweed. These funds should be given to the State Highway Department for equipment, personnel and other expenses involved in the conduct of a Ragweed control program. Roadsides and other areas in State-owned property where Ragweed occurs should be sprayed annually with 2, 4-D solution. This solution also will control poison ivy.

2. Towns and cities should consider granting of funds for the purpose of Ragweed control on their property. Such control programs would alleviate the suffering of hayfever victims who are residents and those who visit the community. Recreational areas will gain economically if they publicize the fact that their community is free of Ragweed.

3. Citizens, property owners including hotels and resorts, and business establishments should conduct control programs on their own property. Local ordinances could be enacted making property owners responsible for the control of Ragweed growth on their land. Penalty for failure to control Ragweed could result in requiring property owners to pay for actual cost of control performed under community direction.

4. Civic and social organizations should give consideration to the conduct of educational campaigns, and active control programs.

5. The State Department of Health should provide technical advice and information to communities, upon request, on matters involving chemical control of Ragweed, growth habits and airborne pollen density measurements.

6. Areas in the State which are essentially free of Ragweed should be publicized highly in order that hayfever victims may find relief from their suffering during the hayfever season. In this connection the State Department of Health should prepare a list of towns and cities where there is essentially no Ragweed and this list should be made available to all interested persons.

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